EXECUTIVE SUMMARY

The Littoral Combat (LC) Future Naval Capabilities (FNC) sponsored a war game during 1-4 April 2002 for the purpose of providing analytical rigor for the development of the LC FNC Science and Technology (S&T) Investment Plan.

Arete' Associates provided the design, development, facilitation and execution of this war game. The game was conducted at the Naval War College War Gaming facility, McCarty-Little Hall, in Newport, RI. Players and participants represented the operational forces and the requirements and development communities of both the US Marine Corps and the US Navy. For a list of participants, see Appendix A.

In developing its S&T Investment Plan, the LC FNC's Integrated Product Team (IPT) directed the FNC to focus on four enabling capabilities; Command and Control (C2), Intelligence, Surveillance, and Reconnaissance (ISR), Fires and Maneuver. These four enabling capabilities formed the focus of the game design and breakout groups. The game was designed to stress the baseline 2010 Marine Expeditionary Brigade (MEB). Shortfalls identified during the game were divided into two groups; those that could be met by modifications to Doctrine, Organization, Training and Education and those that could not. This latter group formed the candidate list for S&T solutions. Technology solution candidates were prioritized by each enabling capability and operational requirements were developed for each.

In a companion effort, the Center for Naval Analyses (CNA) will assess the identified shortfalls amenable to a technology solution appropriate for the LC FNC. They will provide estimates of the threshold and objective characteristics for each of the capabilities and potential technologies to meet the required capability. This work will be developed to support the Technologists' Panel on 30 April 2002 and the Broad Agency Announcements (BAAs) to be published in June.

A total of 209 capability shortfalls were identified by the players in plenary session and parsed out to breakout groups for further discussion. The breakout groups identified those shortfalls they considered to be the highest priority for an S&T investment. A total of 23 shortfalls were identified by the four breakout groups.

Priority shortfalls identified by **C2** breakout group included:

- Over-the-horizon Tactical Communications Relay
- Information Management
- Data Flow optimization
- Assault Platform C2

Priority shortfalls identified by **ISR** breakout group included:

- Personal ISR (shaping) package
- Locally Controlled UAVs (USMC Operated)
- Dynamic Navigation
- Network Architecture

Priority shortfalls identified by **Maneuver** breakout group included:

- Assured Access
- ISR Supporting Precision Maneuver
- Robust and Capable C2 systems
- Adaptive Mission Planning
- Landmines and Obstacle Breaching
- Vertical Assault Force Survivability
- Decontamination
- Force Protection Afloat and Ashore
- Maneuverability of Dismounted MV-22 Forces

Priority shortfalls identified by **Fires** breakout group included:

- Target Location and Engagement
- Netted Fires
- Ashore Counterbattery
- Reduce the "Cost" of Fires
- Responsive Targeting and Taskable Firing System
- Lightweight Mobile Weapon Systems

Subsequent to the wargame, a Technologists' Panel of current and former senior DOD technologists convened at the office of the Navy Chief Technology Transition Officer. The purpose of the panel session was to help the FNC management team translate the operational capability shortfalls identified in the Expeditionary Maneuver Warfare wargame into S&T requirements upon which BAAs could be based. Panel member included:

Dr. Paul Kaminski – former USD Acquisition and Technology
Dr. Alan Berman – former Technical Director Naval Research Lab
Dr. Eli Zimet – former Head, Naval Expeditionary Warfare Department, ONR
Dr. Jim DeCorpo – current Navy Chief Technology Transition Officer

The major theme that the panel reiterated was that the highest payoff technologies to pursue were in the C2 and ISR areas. Even the shortfalls identified in the Maneuver and Fires enabling capabilities could best be addressed, within the constraints of the FNC charter, by improvements in the C2 and ISR support to these operational capabilities. Improving the Common

Relevant Operational Picture and enabling Real Time Adaptive Planning for Dynamic Execution should be the focus of the S&T investment plan.

The Panel made the following specific Enabling Capability S&T Investment Recommendations:

- C2 focus
  - Leverage existing programs in laser communications, conformal antennas and commercial "last mile" connectivity hardware.
  - Determine how to establish the required databases from the population of those that already exist, but stand alone.
- ISR focus
  - Let industry tell ONR what can be packaged into a man portable system rather than ONR constrain industry to an arbitrary weight/cube.
  - Focus on payloads for Naval UAVs, such as Dragon Warrior, rather than attempting to develop a new UAV or packages suitable for transition specifically to the Army UAV program
- Maneuver focus
  - Providing current mapping capabilities across appropriate level tactical platforms will significantly enhance situational awareness and dynamic navigation.
- Fires focus
  - Integration of stovepiped systems into a netted fires system is the greatest potential payoff for S&T investment
  - A robust netted fires system should enhance the expeditionary capabilities of current fire support systems for both point and area targets, as well as address the counterbattery requirement for forces beyond the reach of naval surface fires.

The Panel also made the following specific recommendations not to invest FNC S&T Funds in the following areas:

- Chem/Bio decontamination technology – legislation restricts such programs to the purview of the OSD joint office
- Non-lethal weapons – the Joint Non-Lethal Weapons office owns these programs
- "Cost" of fires – the ammunition acquisition tail is too large and there is a long history of failed munitions S&T programs
- Modular lightweight mobile weapon system – This identified shortfall envisioned a generic new system as a solution. This would be a new program of record, and, therefore, outside the scope of the FNC
- Ashore counterbattery – Nothing in the FYDP satisfied the requirements to solve this shortfall. This would be a new program of record, and, therefore, outside the scope of the FNC.

Table of Contents

Section 1: Introduction

1.1 Game Purpose

The Littoral Combat (LC) Future Naval Capabilities (FNC) sponsored a war game during 1-4 April 2002 for the purpose of providing analytical rigor for the development of the LC FNC Science and Technology (S&T) Investment Plan.

Arete' Associates provided the design, development, facilitation and execution of this war game. The game was conducted at the Naval War College War Gaming facility, McCarty-Little Hall, in Newport, RI. Players and participants represented the operational forces and the requirements and development communities of both the US Marine Corps and the US Navy. For a list of participants, see Appendix A.

In developing its S&T Investment Plan, the LC FNC's Integrated Product Team (IPT) directed the FNC to focus on four enabling capabilities; Command and Control (C2), Intelligence, Surveillance, and Reconnaissance (ISR), Fires and Maneuver. These four enabling capabilities formed the focus of the game design and breakout groups. The game was designed to stress the baseline 2010 Marine Expeditionary Brigade (MEB). Shortfalls identified during the game were divided into two groups; those that could be met by modifications to Doctrine, Organization, Training and Education and those that could not. This latter group formed the candidate list for S&T solutions. Technology solution candidates were prioritized by each enabling capability and operational requirements were developed for each.

In a companion effort, the Center for Naval Analyses (CNA) will assess the identified shortfalls amenable to a technology solution appropriate for the LC FNC. They will provide estimates of the threshold and objective characteristics for each of the capabilities and potential technologies to meet the required capability. This work will be developed to support the Technologists' Panel on 30 April 2002 and the Broad Agency Announcements (BAAs) to be published in June.

The Technologists' Panel was convened to help the LC FNC Program Manager best focus his available funds, and to help structure appropriate BAAs. White papers will be reviewed during July and August and translated into capabilities that can be played during a Technology Insertion game in late September. The purpose of the Technology Insertion game will be to develop an operationally based priority for industry's proposals. The results of this game will be used to develop an S&T Investment Plan for review by the IPT.

1.2 Game Design

A Southwest Asia scenario was used to provide a challenging setting for stressing the capabilities of the baseline 2010 MEB as funded through the current FYDP. This scenario has the benefit of having been approved and validated by the Defense Planning Guidance.

Two vignettes were played. An assured access vignette challenged the MEB with conducting Ship-To-Objective-Maneuver (STOM), while the second vignette required the MEB to conduct sustained operations ashore (SOA). Unlike many similar efforts, the purpose of this game was not to develop tactical innovations or lessons. The tactics were developed prior to the game and presented to the players as a "given" in order to facilitate the actual purpose of the game; identifying the shortfalls in the MEB's ability to conduct STOM and SOA in 2010.

General Charles Wilhelm, USMC (retired) and Rear Admiral Glenn Whisler, USN (Retired) oversaw the development of the CONOPS, scheme of maneuver and task organization in their roles as senior players. The Doctrine and Equipment Requirements Divisions at MCCDC also provided doctrinal and requirements validation to the game.

Details of the scenario and vignettes are included in Appendix B.

1.3 Game Organization

Four breakout cells were designed to provide a forum for experts in their specific areas to identify those capability shortfalls that could not be corrected without a technology solution. The four groups were C2, ISR, Fires and Maneuver. The players in these cells consisted of the Marine Corps Advocates from Headquarters Marine Corps and MCCDC, Navy representatives from OPNAV, Marine Corps requirements and doctrinal representatives from MCCDC and Navy doctrinal representatives from NWDC.

Each cell was assigned a CNA analyst to collect data for CNA's follow on analytical support of the FNC. Representatives of the LC FNC acted as assistant facilitators, with the facilitation directed by Arete' Associates. IPT members and their deputies, as well as senior observers from relevant Navy and Marine offices were on hand to observe and offer input to the game proceedings.

In addition to the four cells addressed above, the Red cell evaluated MEB capabilities and provided an analysis of capability shortfalls from a notional enemy perspective in the scenario. The Red cell was tasked to look at all issues and isolate the shortfalls that, if resolved, would provide the greatest challenges to Red. Conversely, Red was also tasked to comment on those shortfalls that, if resolved, would provide little additional challenge to Red's operation. Thus, this team identified the shortfalls on which Red would most like to see the US expend effort and resources (those with least impact on Red) and the shortfalls on which Red would most desire the US not successfully expend effort and resources (those with most impact on Red). The list of shortfalls developed by Red reinforced the work conducted by the four Blue cells.

Section 2: Summary of Game Results

2.1 Focus of Operational Shortfalls

The game was designed to uncover shortfalls in the projected capabilities of the baseline 2010 MEB conducting STOM and SOA. The operational shortfalls presented to the plenary for consideration and those additional issues derived by the participants focused upon the lack of MEB capabilities to execute an amphibious assault against an integrated anti-access defense and to conduct sustained operations ashore at great distances from sea-based support.

2.2 Nature of Shortfalls Identified

The operational discussions during plenary sessions were intended to allow a full examination of operational shortfalls unconstrained by the potential solution. The parsing of shortfalls into the two solution categories – DOTMLP (Doctrine, Organization, Training and Education, Material, Leader Development and Personnel) and S&T – was reserved for the breakout groups to consider. Accordingly, the identified shortfalls can be characterized in three generic groups – S&T candidates within the scope of the LC FNC, S&T candidates outside the scope of the LC FNC (either appropriate to another FNC or earlier stage "discovery and invention" technology), or not S&T related. During the breakout group discussions, additional issues were solicited even if outside of the scope of the game, but which impacted upon the MEB's ability to conduct STOM and SOA. This was done to take advantage of the collective expertise of the assembled players. These additional issues have been collected in Appendix C.

The major advantage of STOM is the ability to maneuver around anti-access systems (mines, obstacles, air defense, anti-ship cruise missiles, etc.) and opposing forces with sufficient agility to conserve resources and mass fires in support of mission objectives. The key to achieving STOM is the ability to conduct adaptive planning and dynamic execution. Enabled by tactical over-the-horizon communications, information management and data-flow optimization that constrains bandwidth requirements to the "right size" pipe, an improved network architecture that supports appropriate reach back to integrated intelligence databases and resources, and real-time ISR, each level of command will be able to achieve relative situational awareness. This increased relative situational awareness will, in turn, enhance a commander's ability to fire and maneuver, overcome enemy anti-access capabilities and press toward assigned objectives. The specific capability shortfalls identified in the game are grouped into the four component categories of C2, ISR, Maneuver and Fires. The general focus of the capability shortfalls and the capabilities required to overcome them can be summarized by the accompanying graphic in Figure 1.

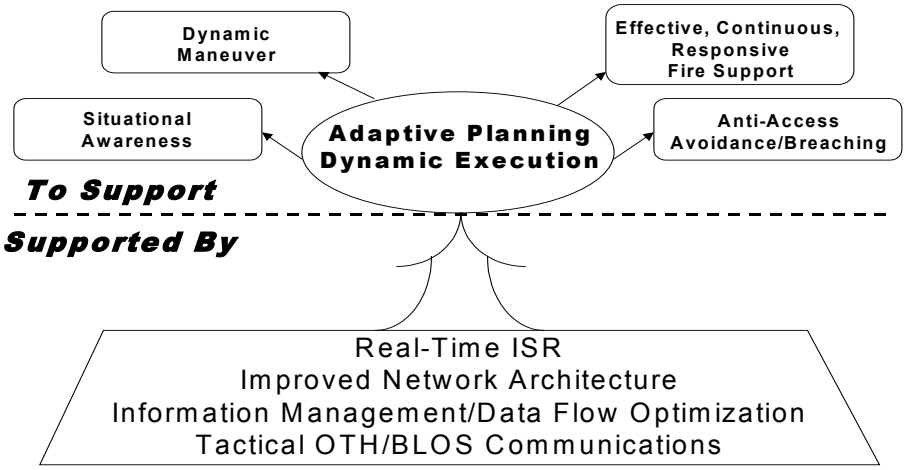


Figure 1. Summary of Capability Shortfalls

2.3 Summary of Operational Shortfalls

The participants examined 209 shortfalls and developed operational capability descriptions for 23 of these shortfalls. The shortfalls identified by the C2, ISR and Fires groups were applicable for both the STOM and the SOA vignettes. These inputs effect the shortfalls common to expeditionary operations across the timeline from initial assault through sustained operations. The maneuver group chose different issues for each vignette as the STOM environment and mission provided a different set of challenges than did the SOA environment and mission.

Table 1 summarizes the number of issues that were assigned to each group and the resulting number of issues that were developed by each group.

Table 1. Summary of Issues by Breakout Group

Issues Assigned to each Group			Issues Developed by each group	
	Vignette 1	Vignette 2	Vignette 1	Vignette 2
C2	32	24	4 (both vignettes)	
ISR	38	34	4 (both vignettes)	
Maneuver	34	33	4	5
Fires	31	22	6 (both vignettes)	

The following paragraphs provide a synoptic overview of the shortfalls that were examined in detail by each of the breakout groups. Each of these is discussed in more detail in Sections 4 through 7.

2.3.1 Synopsis of Command and Control Issues

Over the Horizon/Beyond Line Of Sight (OTH/BLOS) Tactical Communications Relay – ability, particularly battalion level and below, to communicate at ranges up to 400 miles.

Information Management/Decision Support Tools – accessing multi-security level data from all-source databases and making the relevant information available to the appropriate command level.

Data Flow Optimization – “right-sizing” the flow of data to ensure relevant information gets to the appropriate command level.

Dynamic Execution from all Assault Platforms - ability to adapt the STOM plan during execution and communicate those adaptations to all tactical levels in real time.

2.3.2 Synopsis of ISR Issues

Personal ISR package – small, user-friendly device to enhance small unit situational awareness.

Locally Controlled UAVs (USMC Operated) – a mid-range UAV, capable of launch/recovery from both ship and austere runways ashore.

Dynamic Navigation – real-time navigation decision support for adapting the STOM plan during execution.

Network Architecture – all databases and data transfer available on a single robust architecture capable of multi-sensor fusion.

2.3.3 Synopsis of Maneuver Issues

Assured Access – ability to execute STOM against integrated anti-access defense.

ISR supporting Precision Maneuver – method to locate mines, obstacles, and enemy forces from the Line of Departure (LD) to the objective, transmitted to all maneuver units so they can avoid mines and obstacles.

Robust and capable C2 systems – ability to communicate STOM movement across all levels of command and support with a system scaleable to the host platform.

Adaptive Mission Planning – system that provides ability to plan, rehearse and train all aspects of STOM movement (expanded version of current LCAC system).

Landmines and Obstacle Breaching – ability to maintain operational momentum in the presence of various impediments to mobility when unable to avoid such impediments.

Vertical Assault Force Survivability - a mobile fire support system that provides extended coverage to vertical assault forces on the ground outside the naval fires umbrella.

Decontamination – neutralizing agent that is less resource intensive than the current water wash-down systems.

Force Protection Afloat and Ashore – primarily concerned with waterborne assault craft, the ability to detect and engage fast, low signature threats like speed boats and employ non-lethal means for crowd dispersion ashore.

Maneuverability of Dismounted MV-22 Forces – intended to address the need for a capability to provide maneuverability to dismounted air assault forces, the issue focused on enhancements to the ITV.

2.3.4 Synopsis of Fires Issues

Target Location and Engagement – "hands free" (e.g., helmet mounted) system that generates mensurated target locations and transmits "call for fire" in all weather.

Netted Fires – all fires information available on one communication network enabling weapon/target matching and target deconfliction.

Ashore Counterbattery – mobile, 360-degree capability transitionable from ship to shore base.

Reduce the "Cost" of Fires – commonality of components to reduce logistical burden and life cycle cost of munitions.

Responsive Targeting and Taskable Firing System – requirement for more responsive and available fires.

Modular Lightweight Mobile Weapon Systems – commonality of weapons systems - reducing weight while maintaining lethality and range.

2.4 Synopsis of Technology Panel Insights

The Littoral Combat FNC sponsored an experts' panel session with current and former senior DOD technologists on 30 April 2002 at the office of the Navy Chief Technology Transition Officer. The purpose of the panel session was to help the FNC management team translate the operational capability shortfalls identified in the 1-4 April Expeditionary Maneuver Warfare wargame into S&T requirements upon which BAAs could be based.

Panel members included

- Dr. Paul Kaminski – former USD Acquisition and Technology
- Dr. Alan Berman – former Technical Director Naval Research Lab
- Dr. Eli Zimet – former Head, Naval Expeditionary Warfare Department, ONR
- Dr. Jim DeCorpo – current Navy Chief Technology Transition Officer

Other senior participants included

- Wargame Senior Players (Gen Charles Wilhelm and RADM Glenn Whisler)
- FNC IPT Member (Mr. Fred Belen)
- FNC IPT Deputies (Col Gene Daniels and Mr. Bob Smith)
- ONR Senior Management (Dr. Ron DeMarco and Dr. Erv Kapos)

OPNAV N75 (Dr. Frank Shoup)
FNC Management Team
CNA Analysts

The panel was specifically asked to do the following:

- Warn the FNC team of pitfalls to avoid
  - where a lot of money is already being spent
  - where FNC dollars would be insufficient to make a difference
  - where good money has been spent after bad
- Identify opportunities for FNC to exploit
  - where it is worth spending FNC S&T dollars
  - where FNC can leverage ongoing work
- Calibrate FNC expectations -- reality check
- Help FNC management determine how best communicate the S&T requirements to industry, labs and universities

Section 3: Command and Control Shortfalls

The shortfalls selected as most significant by the C2 breakout group are presented in priority order in subsection 3.1 below. These are the shortfalls the breakout group considered candidates for S&T solution. The C2 group answered detailed questions for the high priority S&T candidates they selected. The questions and their answers are at Appendix D. The complete list of C2 shortfalls discussed during plenary session is presented in subsection 3.2. This larger list contains shortfalls the breakout group considered either answerable by DOTMLP work arounds, or lower priority candidates for S&T solutions. This larger list is presented for completeness and further action by other more appropriate resource sponsors.

3.1 Priority Shortfalls

OTH/BLOS Tactical Communications Relay. The essence of STOM – maneuver inside an adversary's reaction time to push inexorably toward the objective – cannot be constrained by any combat capability. All elements of combat power must contribute to operational maneuver and enhance the commander's ability to maintain momentum. One area of particular concern in this regard is over-the-horizon communications. The tactical commander cannot be halted in his advance because he has moved out beyond the MEC commander's communications horizon, nor can he lose his ability to command those forces under him because they have moved beyond his communications horizon. The current shortfall in over-the-horizon communications is an Achilles heel in the pursuit of STOM effectiveness. The C2 breakout group identified this as the most critical shortfall in achieving STOM operations.

Depending on the terrain, over-the-horizon can be the next ridge line or it can be the distance to a forward operating base during sustained operations ashore. Thus, the group established the range requirements as from "over the hill" out to 400 nm. The group tried not to focus on a particular approach to achieving OTH communications capability, but they could not help but think in terms of a relay – either airborne or land-based. They did subject their preferred solution to the following constraints:

- The group preferred a solution that did not rely on satellites, as they considered satellites both oversubscribed by higher echelons during crisis, and too vulnerable to the emerging capabilities of would-be adversaries.
- The group warned against a solution that would require a terrestrially based infrastructure, as they considered this additional manpower requirement to both create a force protection and security vulnerability, and an increase in the logistical footprint ashore.

- The capability developed would have to be interoperable with the Joint Tactical Radio System, as this will be the principal radio system of the future for tactical units at the battalion level and below.

Should the relay capability be satellite based, the group indicated its desire to see smaller and more modular EHF and SHF SATCOM antennas deployed at the tactical level in LAVs and HMMWVs. On-the-move SATCOM capability would add a tremendous capability to the tactical units.

Information Management / Decision Support Tools. Providing the right piece of information, at the right time, to the right person, so that he/she can make the right decision is vitally important to future battlefield success.

The development of information management tools will greatly assist commanders and their staffs in identifying, prioritizing, filtering, fuzing, and displaying information in a manner that will facilitate decision making. These tools could be used to assist in satisfying Commander's Critical Information Requirements (CCIR's), or Priority Intelligence Requirements (PIRs).

Information management tools must be able to tailor information to meet the specific mission needs of a variety of units, both large and small. Initial efforts should be directed at managing information provided by ISR platforms, with follow on efforts directed at the provision of tools for other information. When fully developed, these decision support tools must be able to sort web-based and non web-based data. Semantic web capability (agent based) with level four automated fusion and meta data tagging are initiatives worthy of an S&T investment.

The selection of tools to assist in the development of a common relevant picture tailorable to the user requirements is critical to future battlefield success. These tools must speed the development of situational awareness at every level and be tailorable to the user's specific requirements and needs. Software must have re-routing and self-healing capabilities.

Initial efforts to develop the common relevant picture should focus on the integration of information from ISR platforms. This information is generally the most important and is the most perishable. Follow-on efforts could be directed at integrating other information.

Efforts should focus on those tactical units battalion-sized and below. These units are the farthest from the Common Tactical Picture (CTP) and would benefit the most from any incremental improvements in the ability to provide a common relevant picture.

Data Flow Optimization. In the absence of some attempt to constrain the burgeoning demand for more and more bandwidth to satisfy multi-media communications, the MEB is not likely to ever see adequate communication pipes for its command and control requirements. The breakout group saw two fundamental issues in solving the bandwidth problem. First, a disciplined approach to defining the tactical commanders' real high-bandwidth communications requirements must be taken. Not only can too much information

overload the commander, but complex presentations can also distract him from the fast paced environment on the battlefield. More work needs to be done in the field of understanding human information processing so that the right information can be presented in the right format to the right level. Once the requirements have been established, the communications pipe can be "right sized". This right sized pipe can then be pursued and appropriate technologies to accommodate the required data flow through the pipe can be developed.

Some areas that were specifically identified by the group included reducing the bandwidth demands of such existing systems as AFATDS and TBMCS. Another area for consideration is the development of network management tools that will allow a commander to better understand the impact of decisions related to message prioritization and network access. The marine Air Command and Control System (MACCS) and its successor, the Common Aviation Command and Control System (CAC2S), with their advanced voice, data and track management applications, were offered as templates for an overarching MAGTF Command and Control System.

Dynamic Execution from all Assault Platforms. STOM envisions an OTH attack with the LD well to sea. The distances involved may require the landing force elements to modify their plan once across the line of departure. Provision for dynamic execution, planning adjustments made from the LD to the objective, must be available to the assault troops embarked in both surface and airborne assault platforms.

Providing the assault forces with the ability to dynamically execute provides the Marine Corps with an unparalleled degree of mission flexibility. Providing maneuver units with the command and control capability to exploit the gaps while avoiding the surfaces encountered in STOM provide a level of flexibility and force protection not available to Marine assault forces today.

The ability for forces to dynamically execute the plan by making modifications en-route to the original objective or possibly a different objective, requires that all assault platforms (i.e. AAAVs, LCACs, and all airborne platforms) provide the capability for embarked Marines to receive the common relevant picture. This will allow units to make near real-time modifications to the plan while en-route to the objective, and share this modified plan with all elements of the assault force. The data network supporting the operation must be accessible by embarked forces. Access to the network can be made via a permanently installed piece of equipment in the troop compartment or by a plug that allows the troop commander to plug in a digital automated control terminal (DACT). This capability must be made available to assault forces across all platforms. Specifically, a plug-and-play capability that is scalable to various size units and adaptable to the range of assault platforms, without significant change to platform performance is recommended.

3.2 Candidate Shortfall List

The following list of shortfalls were discussed in plenary session and assigned to the C2 group. This group of shortfalls contains issues the breakout group considered lower priority than those in section 3.1 or obviously not an S&T candidate. The boldface bullets are the obvious capability shortfalls identified in previous games and studies that were presented to the plenary to start discussion. The remaining bullets are the additional issues that were developed during the plenary session.

Vignette 1

- **Exploiting reach back C2 capabilities while embarked (same issue ashore in vignette 2); access to experts and databases**
- Interoperability between JSOTF and Maritime force commander – Horizontal coordination and integration within JSOTF components and vertical (AF) as the MEB arrives in theater and has to integrate assets (particularly strike and ISR assets)
- Linkage between all converging command elements (JFACC, AF, other components in the supported/supporting relationships, interagency, NGO, PVO, and other assets in theater not traditionally controlled by the MEB)
- System interoperability especially between SOCOM elements (separate procurement system from Service components)
- Require an Enroute Mission Planning and Rehearsal System to provide ability to collaboratively plan and rehearse across multiple platforms – system must include all surface and vertical landing craft.
- Direct access to feeds from unattended ground sensors and other systems in theater required by the AF commander and MEB ashore
- Capability to not just “reach back”, but also to “reach out” to non-organic and non-military assets for mission planning, preparation, and execution
- Ability to tag data from any source, catalogue, integrate, and disseminate information
- Ability to fuse information in knowledge management perspective that allows the commander to assess, orient, decide, and act without being overwhelmed by data (provide only the relevant information for the appropriate level of command)
- Small unit leaders lack access to classified data. Require access be provided to small units in packages they can use
- **Growing bandwidth demand (for video, imagery, other?)**
- Require a means to package commander’s requirements and information to technically reduce bandwidth requirements – it’s a bandwidth management problem AND a technological requirement to ensure the right information can be transported.
- Lack the ability to provide a useable, dynamic common operational picture, tailored for specific commander’s requirements

- Digital/analog mismatch between intermediate command levels. Different systems with different capabilities (interoperability of systems and tailored by requirements).
- Mismatch in raw information that is gathered and ability to transmit it - we can gather more than we can pass – information management and bandwidth issues
- Ability to push UP information from the lower level – it's not all push down intell it's also push up packages for the commander to put intell requirements in perspective for the maneuver commander
- Technology to "compress" data like imagery to ensure it can be passed up through the smaller pipes at lower levels – commanders all demand more corroborating data
- Scaleable systems – as MEB commander accepts control of arriving forces he may have to increase his ability to integrate systems
- Need to create a system that advances from COP – Common Operational Picture -- to CROP -- Common RELEVANT Operational Picture.
- **Vulnerability from single points of failure (SPOF) in MEB C^2 system (identification and protection)**
- SHF not on the small decks – SHF will always be a SPOF if only on the large decks
- When the big pipe is out of the picture – how do we operate if all doctrine is driven by the availability of the large pipe at the AF level
- The big decks offer redundancy for large pipe re-transmission, but they also increase footprint, training, asset allocation, resources, etc – can we find a technology work around?
- OTH comms or BLOS comms relying on single airborne relays can create SPOFs
- GPS is a SPOF as it is critical to targeting, maneuver, CROP, IFF, combat ID, etc.
- Require the ability to move collaborative planning tools between physically separated platforms
- Greater requirement for collaborative activities between CVBG, forces ashore, etc.
- **Interoperability shortfalls with the 2010 C^2 system (Navy-Marine and ground-air)**
- Ability for AAAV navigation, ship-to-shore movement, and coordination of assets enroute and tie into larger C2 picture
- Require the ability to monitor, update, and advance software "fixes" to all user stations for any C2 system. This ensures continuous interoperability and greatest capability for deployed forces.
- Ground combat identification and IFF communications for CAS, UCAV etc to retarget in-flight.
- Systems can be robust and exist afloat – but the systems also have to be able to operate in multiple environments and be capable of transitioning ashore.

- **Ability to conduct simultaneous operations with platforms that are multi-mission tasked (e.g., UAV that is gathering information through on-board sensors, acting as OTH comm relay, and capable of engaging targets)**

Vignette 2

- **Exploiting reach back capabilities for C2 when ashore in theater**
- Most issues of connectivity are similar to those for STOM; terminal points now ashore may create new issues
- Less capable reach-back connectivity ashore than afloat. There may be a very different flavor and requirement for reach back now that we are in a more complex environment ashore. Need to minimize footprint for transmitters ashore
- MEB has full range of comms (including satellite connectivity) but tactical maneuver units need greater capability than currently available
- Require greater capability to conduct maintenance and have access to spares ashore
- Ability of maneuvering units on the move to have connectivity to reach back assets (bandwidth AND antennas)
- Ensure two-way linkage with Joint Interagency Coordination Group (JIACG) cells at the CINC HQ
- **Inability to maintain and disseminate a common tactical picture**
- Requirement for real time feeds from sensors to tactical units
- **C^2 shortfalls for providing "real time" information from headquarters afloat to tactical units operating at great distances ashore**
- **Security deficiencies with the 2010 C^2 system (Computer and network security)**
- Require dynamic solutions to Computer Network Security – must be coordinated with developing TTP
- **Shortfalls in conducting combat assessment**
- Ability to assess more than kinetic kills – need to assess success of systems attacks, remaining functionality of targets
- Self-contained BDA capability onboard the "round"
- Assessment as it relates to the operational plan and the ability to determine where we are in the operation. Require capability for Commander to be able to assess the situation at decision points for dynamic execution of the adaptive plan. – Assessment and target development are issues for more than just ISR – fires, maneuver, and C2
- Require tools to conduct combat assessment tools and manage information
- **Management and visualization of data to provide the commander "decisionable" information**
- System to support processing information – adaptable to the individual commander to enable rapid/accurate decision making
- Matching cognitive styles of the commander with the tools available

- Spectrum of information content – functionality of the command to ensure decisions consider current and future capabilities of the force

Section 4: ISR Shortfalls

The shortfalls selected as most significant by the ISR breakout group are presented in priority order in subsection 4.1 below. These are the shortfalls the breakout group considered candidates for S&T solution. The ISR group answered detailed questions for the high priority S&T candidates they selected. The questions and their answers are at Appendix E. The complete list of ISR shortfalls discussed during plenary session is presented in subsection 4.2. This larger list contains shortfalls the breakout group considered either answerable by DOTMLP work arounds, or lower priority candidates for S&T solutions. This larger list is presented for completeness and further action by other more appropriate resource sponsors.

4.1 Priority Shortfalls

Personal ISR Package. The requirement exists for a single lightweight ISR product to enhance the capabilities of the small unit. This system should securely send/receive digital image, motion, multi-spectral information (IR, penetrating for MOUT and caves, thermal, etc.), location (GPS), lazing information for target (identification, classification, designation, location, and dissemination) and connect with unattended sensors.

This system must possess a reduced signature and should be a hand-held Palm-Pilot – like system. The system should be capable of providing video/IMINT for the individual Marine and possess see-thru/see-into capability for caves and buildings. The system should not be one system/one man, but a team system easily transportable and usable by one man. Burst transmission is required to reduce signature.

The system must be small enough not to add significantly to the Marine's load and possess a long endurance, light weight power supply. System should have the ability to do OCR scanning for captured documents – a lesson learned from Afghanistan veteran that was a member of the ISR group.

Locally Controlled UAVs. The MEB requires a unique capability for a deployable UAV that can make an entry to a non-permissive environment from the near offshore (not LIC with USN UAVs). The system must be capable of operating from ships and austere runways; VTOL preferred. There is no current system with this capability

USMC Dragon Eye and Dragon Warrior are a good start along the path. This proposed system would bridge the gap between Dragon Warrior and Global Hawk. The operating parameters must be developed to be compatible with sensor packages, which must be compatible with mission-based intel demands. The system must be developed to operate as an ISR platform in urban environments.

System should ship-launchable and ship-recoverable without impacting ongoing flight operations. It should be a medium range (250 miles) and have a minimal footprint for a ground station. It must be capable of "tracking

while hovering or orbiting" and have interchangeable, modularized sensor packages optimized for the particular mission.

Dynamic Navigation. The MEB conducting STOM in 2010 requires a tailored, flexible, integrated dynamic navigation system. The system must provide track management and be capable of predictive modeling and automated template overlays. This system will provide operator-level situational awareness and in-stream navigation. The system should be designed to detect surface obstacles and environment changes first with a desired ability to detect undersea contacts and incoming fires.

The system should be compatible with GCCS and other 2010 communications devices. It should be targeted at performance in the sea-space as a primary operating environment with the requirement to extend the concept ashore. It should be scalable to other platforms and applications.

Network Architecture. The 2010 MEB requires an over-arching network architecture to fuse together disparate elements of the network. This architecture would require sensor interoperability and cross cueing. It would be capable of fusion, correlation, and contact ID. The architecture should also have built-in capability to conduct data tagging, sanitization and filtering of data. It should possess satellite-selectable encryption levels. It is preferred to operate in the HF spectrum (Avoid SATCOM).

This capability will largely be a function of systems integration; any incremental improvement will increase capability.

4.2 Candidate Shortfall List

The following list of shortfalls were discussed in plenary session and assigned to the ISR group. This group of shortfalls contains issues the breakout group considered lower priority than those in section 4.1 or obviously not an S&T candidate. The boldface bullets are the obvious capability shortfalls identified in previous games and studies that were presented to the plenary to start discussion. The remaining bullets are the additional issues that were developed during the plenary session.

Vignette 1

- System interoperability, especially between SOCOM elements (separate procurement system from Service components)
- **Exploiting reach back capabilities to access national intelligence data bases and assets while embarked (same issue ashore in vignette 2)**
- Direct access to feeds from unattended ground sensors and other systems in theater by the AF commander and MEB ashore

- Access to Subject Matter Experts and databases that provide pre-mission planning and interactive mission planning from non-organic sources
- Access to mission support sites that can track teams and provide proactive information to the deployed commander – issues are speed and pipe size to gather and disseminate information in a dynamic environment
- Need to leverage the Joint Interagency Collection Center and the new Joint Interagency Task Force concept in theater command – soft data, political information, and expert judgments – creation of National Knowledge Advantage Center that fuses large volumes of disparate data for commanders

- Capability to not just "reach back", but also to "reach out" to non-organic and non-military assets for mission planning, preparation, and execution
- Ability to tag data from any source, catalogue, integrate, and disseminate information
- System to prioritize and disseminate intell requirements (size of the pipe is part of the issue), and the ability to build intell systems into the battle rhythm for responsive support
- **Non-availability of organic ISR assets for the collection and dissemination of tactical data (surf and land obstacles, mines, mobile enemy assets, electromagnetic spectrum) in real or near real time**
- Recon element and radio recon platoon are in the MEB, but to what degree do they need to be augmented and where are the assets short (organizational issue or S&T issue?)
- Lack of visibility, radar, etc to the AAAV commander, especially as they maneuver inside the Littoral Penetration Zone (LPZ)
- Ability to control ISR assets in STOM afloat during maneuver past LD
- Need for additional ISR assets not only to track enemy targets but also friendly forces in the LPZ
- Organic UAV systems (Dragon Eye, Dragon Warrior, upgraded Pioneer) – & non-organic assets that are operating inland in support of STOM have to be integrated with ISR plan and be provide coverage throughout LPZ.
- UAV assets that can be operated from mobile locations (like AAAV enroute) to support maneuver and combat from LD in to shore
- Very Shallow Water (VSW) assets are still insufficient, manpower intensive, and are inefficient and dangerous; some form of covert and survivable system is required.
- ISR assets that support "precision maneuver" inside the LPZ
- Require ISR assets to identify and detect obstructions in the water AND support SOA. System must also be used to support other (non-USMC) force entry over the shore
- Ability to fuse information in knowledge management perspective that allows the commander to assess, orient, decide, and act without being overwhelmed by data (provide only the relevant information for the appropriate level of command)

- Small unit leaders lack access to classified data. Require access be provided to small units in packages they can use
- **Non-availability of ISR assets for the collection and dissemination of environmental data (hydrographic, meteorological) in real or near real time**
- Environmental information beyond METOC – includes terrain, civil infrastructure, etc that affect maneuver and support
- Maneuver/intell systems that allow waypoints to be adjusted enroute as threats are identified and tracked to alter scheme enroute for follow-on assets
- **Require integration of sensor systems and access by tactical units to data from the sensors**
- Require ability to task national assets. Require access to "soft information" (other than pure tactical enemy locations) as well. Require the ability to create knowledge packages to support rapid decision making at the MEB that mirrors the kinds of assets being developed for the theater commander
- Need to find ways to cull data and not overtask sensors
- **Lack of ability to achieve and maintain "eyes on target"**
- Requirement for accurate initial location of targets and then maintaining constant "stare and dwell"
- VSW MCM issue – requirement to track contacts to provide information on reseeding of minefields and reconstitution of anti-access forces and capabilities.
- Real time feed of information with target-solution-level data
- Ability to defeat D&D capabilities and the ability to "locate, tag, and track" remotely and constantly
- Over the horizon comms to support targeting
- Ability to integrate IFF and combat ID to reduce potential for fratricide
- **Inability to dynamically re-task intelligence systems (national, theater, and organic)**
- Require collection management – upper levels of command identify needs of tactical level units and then reorient/re-task assets from their level to meet the revised collection management plans
- The ability to cross cue assets to provide more robust intell picture, determine capabilities, correlate data and dynamically task assets to attack (or re-attack) targets
- Ability to operate across different security levels and access different levels of data – ability to share data with others including allies and coalition partners – creation of a dynamic "intelligence picture" that integrates different collection sources
- Readily available picture that protects collection methods and sources
- **Communications ranges and OTH missions compatibility with the ISR missions**

Vignette 2

- **Exploiting reach back capabilities to access national intelligence data bases and assets when ashore in theater**
- Increased demand for imagery and NIMA products
- **Inability to maintain and disseminate a common tactical picture**
- Requirement for real time feeds from sensors to tactical units
- **Language and dialect translation for interaction with foreign nationals during ground operations**
- Requirement for some dialect translators who UNDERSTAND the culture/politics/society – Continue to improve capability of machine-based translation
- Not just voice translation but also the ability to generate translation of written documents for immediate exploitation
- **Inability to conduct predictive intelligence**
- Remote sensors to build underlying database of information on which to build predictive intelligence model
- The ability to sort information that is relevant to predictive analysis
- Ability to link information from the larger database to form a “cluster of information” that provides a basis for predictive intelligence
- TBM/chemical warning using theater AND reachback intelligence assets to provide tactical warning
- Predictive modeling on dispersal patterns and effects affected by climate factors, environment, terrain, etc
- Mapping programs to provide known threat locations, predict suspected locations and template together to provide a predictive picture
- Sensor netting
- Integrating IPB products and other reports from other sources to provide a complete picture that can link to, and cull from, joint operational net assessments
- **Identification and rapid negotiation of land mines and obstacles ashore**
- In-stride breaching issues should cover from LD to objective regardless of depth of mine in water
- MEB still needs capability to expand mine detection beyond 2010 capability – wide area identification (if not clearing)
- Ability to detect command-detonated mining and avoid or neutralize
- **Shortfalls in conducting combat assessment**
- Ability to assess more than kinetic kills – systems attacks, functionality
- Self-contained BDA capability onboard the “round”
- Assessment as it relates to the operational plan and the ability to determine where we are in the operation. Require capability for Commander to be able to assess the situation at decision points for dynamic execution of the adaptive plan – Assessment and target development are issues for more than just ISR – fires, maneuver, and C2
- Require tools to conduct combat assessment tools and manage information
- **Requirement for combat ID in all four environments (Air-Air, Air-Ground, Ground-Air, Ground-Ground)**

- Composite, fused combat ID that draws on all sensor systems that feed the system
- Require integration of existing systems and processing of information on the common system to aid in developing the CROP
- **Vulnerability of MEB to Ballistic Missile Attack**
- Development of deception and denial to support the MEB against Ballistic Missile (BM) attack
- Development of ground-based sensor system to ID and track BM integrated with "Shooter" – anti-BM Defense missiles – are there COTS systems that the MEB can employ?
- **Shortfalls in detecting the presence and type of NBC threat or contamination, individual protective gear, and decontamination**
- Deficiencies for operating in an NBC-contaminated environment for the MEB (ground and air operations)
- Inability to rapidly and efficiently handle, process, and move contaminated casualties – providing medical care (to include surgery) to contaminated personnel
- **Ability to predictively model an adversary's other vulnerabilities like CSS capabilities – when does the enemy run out of fuel, food, bullets, etc?**

Section 5: Maneuver Shortfalls

The shortfalls selected as most significant by the Maneuver breakout group are presented in priority order in subsection 5.1 below. These are the shortfalls the breakout group considered candidates for S&T solution. The Maneuver group answered detailed questions for the high priority S&T candidates they selected. The questions and their answers are at Appendix F. The complete list of Maneuver shortfalls discussed during plenary session is presented in subsection 5.2. This larger list contains shortfalls the breakout group considered either answerable by DOTMLP work arounds, or lower priority candidates for S&T solutions. This larger list is presented for completeness and further action by other more appropriate resource sponsors.

5.1 Priority Shortfalls

Assured Access. Amphibious power projection is all about access. As potential adversaries view US power projection capabilities, they exhibit a growing sense of their inability to withstand US military force once our forces have gained access to the battlespace. There is a growing desire among less capable military powers to develop an access denial strategy to prevent US forces from bringing our massive power projection capabilities to bear. These access denial strategies combine a mix of systems from low technology mines and obstacles to high technology air defense systems. It is the low technology mines and obstacles that most concerned the maneuver group as we have yet to overcome them. It is the ability to move from the LD to the objective area unimpeded by mines and obstacles that the group called “assured access”.

Unlike earlier operational concepts for amphibious assault in which assault forces would take straight-line approaches to the beach, suffering attrition from mines along the way, STOM seeks to avoid mines and obstacles, conserving combat power for the objective. This requires an ability to detect and classify mines in real time, and to disseminate this information to the assault forces, in a manner that allows the forces to avoid these threats and dynamically execute an adaptive mission plan. The essence of this maneuver requirement, therefore, is actually ISR for the detection and classification of mines, and C2 for the dissemination of that information and the dynamic replanning of the mission. This capability must be available day/night, in all weather and in non-permissive environments.

ISR Supporting Precision Maneuver. The assured access shortfall was focused on the ISR and C2 necessary for the MEB commander to maneuver his forces around threat areas. This ISR-supporting-precision-maneuver shortfall is focused on the platform displays necessary to present this threat and adaptive mission planning information to the tactical commanders. The group discussed the need for presentation not only of mines and obstacles, but also of other craft locations – friendly and enemy – with a refresh rate sufficient to enable real-time

collision avoidance. An aging feature that visually depicts the quality of system tracks was also considered to be a valuable system addition, as was the ability to identify threat levels in specific areas where insufficient data had been collected to warrant a definitive threat evaluation.

Because the information displays are envisioned for all platforms, the presentations must be scalable to different command levels.

Robust and Capable C2 System. Both of the maneuver priority shortfalls discussed above, as well as all the C2 and ISR shortfalls, inherently demand a robust and capable C2 system to carry the data and enable STOM in constantly changing battle conditions. Thus, this particular shortfall encompasses many other shortfalls. Once doctrine and training have been modified to make use of the advanced C2 and ISR systems envisioned in the wargame, those systems must remain operational throughout the conduct of the operation. Moreover, these systems must integrate all the supporting operations so that adaptive mission plans incorporate all elements of the MEB's combat power.

Adaptive Mission Planning. This shortfall is similar in concept to the dynamic-execution-from-all-assault-platforms shortfall identified by the C2 breakout group. It differs in its concentration on the specific capabilities needed to enable maneuver vice command and control. The group likened the envisioned system to an enhanced version of the LCAC mission planning system expanded to incorporate the broader requirements of the entire MEB.

This capability would require full integration of other systems and relevant databases including ISR, environmental, threat, etc. (MEDAL and EDSS) to establish a common planning environment and a high level ship to objective maneuver plan, with detailed planning down to the craft level. It would include the ability to simulate plan execution and rapidly adapt the plan to accommodate changes in the tactical situation. It must include the ability to monitor the situation and dynamically change the plan during execution. An additional benefit of this system would be the ability to evaluate fuel consumption, offload and transit times, etc.

This planning tool would provide a more rapid means to examine courses of action (COA) and conduct detailed planning to support selected COA. It would provide a historical database of previous plans that can rapidly be adjusted for current operations. This system would provide a basis for collaborative planning across platforms and units.

The system must provide the ability to link units BLOS to the objective and the ability to link to LAN and conduct rehearsals and training across platforms over a secure system. It must be ship and shore compatible.

Landmines and Obstacle Breaching. Ideally the landing force will have the requisite ISR and adaptive planning capability to avoid mines and obstacles

en route to its objective. If unable to avoid the threat, the MEB must possess the ability to detect, identify and breach a variety of obstacles and obstructions to conduct STOM and SOA. This capability for in-stride breaching ranges from the LD throughout the sea and land maneuver space to designated objectives ashore. In addition to landmine detection and lane clearing, identifying and marking cleared areas and danger areas are required. This system must ensure that MEB elements can maintain op tempo, momentum and unimpeded maneuver. The ability to rapidly bridge obstacles, ditches, and bridges is required. This system should also possess sensors to provide rapid, wide area detection of explosives and should have the ability to identify potential ambush sites and areas where natural features could be exploited to create an obstacle. A sensor to detect the presence of humans lying in an ambush site is desirable.

Current capabilities are limited or aging and are manpower intensive. The current method is not an integrated capability with the combat force, but is typically a reach-back capability.

An unmanned, standoff system is needed – a low observable system is preferred to enhance the covert nature of detection and identification. The system must relay information back to the maneuver units. The system must provide the capability to operate with the Assault Breacher Vehicle (ABV), as the ABV proofs the area after it is cleared.

Vertical Assault Force Survivability. The MV-22 delivered force is most vulnerable to enemy fire when operating outside the fire-support umbrella of naval surface fires or organic artillery. A capability to provide this umbrella, whether through the extension of NSFS or organic artillery coverage, enhancement of close-air-support tasking, or the development of a new maneuver weapon system, must be responsive and locally tasked. Time of flight was a particular issue addressed by the group. There was concern that long range fires from distant tubes (sea or shore based) would not be sufficiently responsive to the demands of combat operations. One possible solution discussed was a family of loitering munitions that would overcome the time of flight issue by remaining on station, available for local tasking.

Point and area fires were discussed by the group as requirements for the MV-22 dismounted force. Counter-battery capability was also identified as a matter of concern. For any of these capabilities, if they are to be provided in the form of an organic system, they must be transportable by tactical-unit maneuver assets at least an HMWWV and preferably an MV-22 internally transported vehicle.

Decontamination. The current MEB capability to decontaminate is both resource and time intensive. The MEB must be provided the capability to detect and avoid contamination at the element/unit level to prevent becoming contaminated.

Since avoidance is not always possible, the MEB requires a less resource intensive method of decontamination. A waterless method is needed for forward decontamination when logistics support is limited. A neutralization agent that can be quickly applied to vehicles and equipment for instant decontamination is desirable. The agent should be of sufficient durability and persistence that it could also be applied to equipment and vehicles prior to entering a potential threat area for protection and instant decontamination upon contact with contaminants. Any system that is developed to deliver this method of decontamination must be lightweight and portable (HMMWV transportable). The objective for this capability is the rapid restoration of combat power and the ability to re-deploy to Amphibious Force (AF) shipping.

Force Protection Afloat and Ashore. The group considered force-protection threats to the main body of the AF and the maneuver units throughout the amphibious operating area to the objective area ashore. These threats, particularly prevalent in access denial scenarios, threaten the main body when conducting the operation and when offloading the follow-on echelon after the assault, and the maneuver units, themselves, from the to the objective area.

For high speed threats to AF units – main body and maneuver – a capability to detect, track and engage low signature targets is required. The current capability is inadequate in each of these areas. Taking a lesson from the USS Cole, the group discussed the need for an ability to detonate explosives hidden aboard craft whose threat was not immediately obvious. Directed energy was offered as a potential technology that would allow US forces to irradiate an area and detonate explosives before they came within lethal radius of the targeted US asset. Directed energy was also discussed as a technology that might be used to disable a small, threat-craft's propulsion system if it could not be taken directly under fire.

A final area discussed by the group was port security. An area denial capability that could disperse crowds around ships moored in port, or other vulnerable shore installations was also discussed.

Maneuverability of Dismounted MV-22 Forces. The group discussed the limitations of a vertically inserted maneuver element once it had dismounted from its MV-22. The ITV program has suffered technical setbacks due to the inability of the MV-22 to accommodate such a load within its composite frame. The group discussed the need for some replacement for the ITV concept, meeting the same mission requirements, but overcoming the technical challenges that caused the demise of the ITV program. (During discussions at the Technologists' Panel, this topic resurfaced. The technical issue appears to be that the composite MV-22 structure is incapable of withstanding the material stress associated with the weight and dimensions of the ITV. The MV-22 deck is not suitably reinforced to accommodate the vehicle.)

5.2 Candidate Shortfall List

The following list of shortfalls were discussed in plenary session and assigned to the Maneuver group. This group of shortfalls contains issues the breakout group considered lower priority than those in section 5.1 or obviously not an S&T candidate. The boldface bullets are the obvious capability shortfalls identified in previous games and studies that were presented to the plenary to start discussion. The remaining bullets are the additional issues that were developed during the plenary session.

Vignette 1

- System interoperability, especially between SOCOM elements (separate procurement system from Service components)
- Require an Enroute Mission Planning and Rehearsal System to provide ability to collaboratively plan and rehearse across multiple platforms – system must include all surface and vertical landing craft.
- Very Shallow Water (VSW) assets are still insufficient, manpower intensive, and are inefficient and dangerous; some form of survivable and covert (desired) system is required.
- ISR assets that support "precision maneuver" inside the LPZ
- Require ISR assets to identify and detect obstructions in the water AND support SOA. System must also be used to support other (non-USMC) force entry over the shore
- Maneuver/intell systems that allow waypoints to be adjusted enroute as threats are identified and tracked to alter scheme enroute for follow-on assets
- **Inability to conduct dynamic mission planning (real time ISR feeds, collaborative planning, and dissemination) across the elements of the MEB**
- Dynamic mapping and cartography to support mission planning especially as the MEB maneuvers across the LD and selects alternate LPPs
- Need to leverage existing prototypes for mission planning and expand capabilities to include a tool for all Amphibious assault platforms, air and surface
- **Shortfalls in MEB lift for an RLT**
- From LD forward, there is a problem with moving the GCE forward via MV-22, transporting prime movers, etc.
- Inability to move assets, resupply, and sustain widely dispersed operational forces
- Requirement for an "unmanned" delivery system for transporting troops and supplies to objectives
- **C2 in STOM. (air command and control model -- centralized control and decentralized execution) Control of surface tracks.**
- Update of maneuver unit situational awareness when vectors are changed during STOM

- The ability of small maneuver units to call on decision-support systems enroute (and use that info – decision aid systems and training)
- The ability to create and institutionalize more robust and capable C2 systems at lower tactical levels – centralized planning and decentralized execution works to the LD, after that the commander enroute has to execute branch and contingency plans as the situation dictates
- Ability to work through the issues of breaching, salvage, and other activities being conducted in the LPZ and forward of the LD during maneuver and that impact the tactical plan enroute
- Adjustment of supporting fires when vectors are changed during STOM.
- Update of unit location and vector changes to adjacent units during STOM
- **Recovery of damaged AAAVs**
- Ability to recover contaminated AAAVs returning from the LPP
- **Recovery of damaged LCACs**
- Ability to recover contaminated LCACs returning from the LPP
- **Access assurance (In-stride breaching or by-pass of mines and obstacles in VSW)**
- The ability to create and maneuver through precision breaching or the ability to create wide-swath breaching that provides maneuver space in the LPZ
- Unmanned, remotely piloted, or other technological breaching capabilities
- **Small boat threat in the LPZ and forward of the LD**
- Ability to target fast moving targets in the maneuver area
- Combat identification issues in converging forces
- Require an automated system to allocate targets to firing systems to ensure coverage of multiple targets
- Ability to counter “swarm tactics”, especially with forces behind, arriving at, and departing the LD
- Port security/protection for off-load of follow-on elements
- Ability to integrate other Service forces operating in and around port facilities

Vignette 2

- Minimize footprint and real estate requirements for transmitters ashore
- Impact of reach back for maneuvering units on the move (bandwidth AND antennas)
- **Inability to maintain and disseminate a common tactical picture**
- Requirement for real time feeds from sensors to tactical units
- **Maneuverability of MV-22 inserted forces**.
- Requirement to reduce Soldier load – weight, cube – and provide for speed in employment of heavy crew served weapons
- Internal transported vehicles – vehicle mix, number, capability, functionality
- Changes in vehicle/aircraft engineering to improve load and carry without sacrificing speed or survivability
- Must focus on “what do we want the vehicle to do” rather than how it can be transported by a MV-22 (internal or external).

- Require a real-time CROP to place Marines in the right place more quickly and reduce ground maneuver requirements of Vertical Assault force
- Require parallel development of DOTMLPF with systems to form concept of employment
- **Identification and rapid negotiation of land mines and obstacles ashore**
- In-stride breaching issues should cover from LD to objective regardless of depth of mines in water or ground
- Require greater capability to expand mine detection beyond programmed 2010 capability – method for wide area identification of mines (if not clearing)
- Ability to detect command-detonated mining and avoid or neutralize
- **Require systems to increase the survivability of the MV-22 (armed escort, stealth, route planning, decoys)**
- Vulnerability of the vertical assault force outside the range of NSF weapons
- Inability to perform extended time and depth SEAD – weapons and doctrinal challenges
- Situational Awareness suite in MV-22 to increase survivability of the Vertical Assault force
- **Shortfalls in detecting the presence and type of NBC threat or contamination, individual protective gear, and decontamination**
- Requirement for developing greater capabilities for operating in an NBC contaminated environment for the MEB (ground and air operations, re-supplying, refueling, re-arming)
- Inability to rapidly and efficiently handle, process, and move contaminated casualties – providing medical care (to include surgery) to contaminated personnel
- Vulnerability of ships and forces in port while off-loading, berthed, or re-supplying
- Vulnerability of individuals in an environment where Chemical, Biological, or Radiological agents may be employed
- Require a greater ability to protect, camouflage, manage the signature, and provide protection for the individual
- Signature management – methods and systems to protect our forces by reducing all signatures
- Force protection – afloat – require onboard and off-board countermeasures
- Protection from “swarm” – provide “close-in sea control”
- COMSEC vulnerabilities – require low probability of intercept for all transmissions AND ability to encrypt data

Section 6: Fires Shortfalls

The shortfalls selected as most significant by the Fires breakout group are presented in priority order in subsection 6.1 below. These are the shortfalls the breakout group considered candidates for S&T solution. The Fires group answered detailed questions for the high priority S&T candidates they selected. The questions and their answers are at Appendix G. The complete list of Fires shortfalls discussed during plenary session is presented in subsection 6.2. This

larger list contains shortfalls the breakout group considered either answerable by DOTMLP work arounds, or lower priority candidates for S&T solutions. This larger list is presented for completeness and further action by other more appropriate resource sponsors.

6.1 Priority Shortfalls

Target location. The Marine of 2010 must have the ability to provide Targeting confidence -- the ability to generate mensurated target location, transmit call for fire, and engage within USMC standards. Issues associated with the development of a system to provide this capability include balancing size versus range, power supply, initialization, all-weather and all-visibility capability. The system should be capable of providing targeting, transmission, and engagement in real time, and be hands-free (i.e., observer must not be bound to map, hand held lazing, positioning devices, or handsets – must be able to maintain perspective on wider battlefield while calling fires) to allow for calling and controlling fires while retaining situational awareness.

This capability reduces or eliminates the requirement for sensor confirmation on precision targets and volume fires. It provides accurate target location and designation out to the maximum extent possible, day or night, with minimum weight and the ability to set-up on the move. It must be reliable with long duration power supply. It must provide the ability to reduce initialization time.

Netted Fires. A system is required that possesses the ability to tie in sensor, C2, and engagement platforms and systems across the battlespace. It must provide the capability for weapon/target matching and target deconfliction with the ability to create an automated sensor-to-shooter engagement architecture. The network must be supported by over-the-horizon comms. The system must provide increased responsiveness of fires during the operation, especially during STOM. It must enable more efficient weapon-target pairings and increased ability to manage resources. It must be interoperable and mutually supporting of other systems and integrate all C2 and fire support systems (GCCS, AFATADS, TBMCS, etc).

Ashore counterbattery. In 2010, the Marine must be provided the ability to detect, acquire and fix threat indirect-fire systems' locations (360 degrees) at the range of threat weapons, employing a light, portable system capable of operating on the move and transitioning ship-to-shore and transmitting target locations to the counterfire network. Issues for this capability include power supply, size, computing power to target in less than 3-D, and man-safe operations.

STOM requires a light, portable counterbattery system capable of operating on the move. The system must support transition from ship-to-shore while transmitting target locations to a dedicated counterfire network. This system provides protection and counterbattery capability while on the move. It supports transition through the LPZ.

The "cost" of Fires. One of the greatest impacts of the increased ranges at which STOM must be executed is the lack of responsive fire support coverage throughout the battlespace. The requirement exists for an extended range munition (beyond the range of ERGM) that can be fired in volume, with a size and weight less than current ballistic rounds, and with adjustable "yield/effect" capabilities that can be fired from sea-based platforms. This system must fire ammunition sub-components (explosive filler, guidance systems, and fusing) that possess commonality and a reduced cost guidance systems must be developed to support volume fires.

Future systems and munitions must address the following problem areas. Precision systems are expensive and cannot produce volume fires at an acceptable cost (ERGM Guidance = approximately 80% of the cost). “Dumb” systems do not have range to support STOM doctrine, especially in urban areas where collateral damage is a consideration. Magazines “cube out” when precision munitions are employed. Naval fire and MEB systems are not compatible, increasing the burden on magazines, logistic systems, etc.

Responsive Targeting and Taskable Firing System. STOM requires a system that reduces the time from acquisition and targeting to arrival of ordnance. The system must be a reduced Time-of-Flight (TOF) weapon that still achieves the effects required by the MEB commander to address both precision and volume fires. It must possess station time to ensure duration coverage, dwell, and ability to assess and reattack as required. Munitions should provide the ability to “dial up” the effects required

Commanders need systems that support constant stare and dwell as well as the ability to assess and reattack as required. Loitering munitions and long-range, sea-based munitions with reduced TOF provide the ability to attack time-sensitive and other high pay-off targets in the most efficient manner. Lower cost, responsive systems more effectively support the tactical call for fire.

Modular, Lightweight, Mobile Weapon Systems. In order to overcome the logistical burden associated with MEB fires, a lightweight system is required for organic employment with MEB elements. The system must be internally transportable by MV-22, capable of achieving the effects of all indirect fire systems currently organic to the MEB with mobility comparable to maneuver units once deployed.

This capability must reduce the footprint ashore and must address logistics, interoperability and compatibility issues. Current fire support systems must be employed in “layers” where gaps may affect maneuver. Multiple systems complicate the targeting process and increase interconnectivity issues and Fire Direction Center coordination/target deconfliction.

The near term solution for this capability may be enhancements to the EFSS program. Desirable changes would be transportable with ITV as prime mover for vertical assaults, internally transportable with an ITV in the same MV22, transportable with a LAV, AAAV, or HMMWV as prime mover for surface

forces, an increase in the range of the system, and small but common munitions.

6.2 Candidate Shortfall List

The following list of shortfalls were discussed in plenary session and assigned to the Fires group. This group of shortfalls contains issues the breakout group considered lower priority than those in section 6.1 or obviously not an S&T candidate. The boldface bullets are the obvious capability shortfalls identified in previous games and studies that were presented to the plenary to start discussion. The remaining bullets are the additional issues that were developed during the plenary session.

Vignette 1

- System interoperability, especially between SOCOM elements (separate procurement system from Service components)
- **Lack of ability to achieve and maintain "eyes on target"**
- Requirement for accurate initial location of targets and then maintaining constant "stare and dwell"
- VSW MCM issue – requirement to track contacts to provide information on reseeding of minefields and reconstitution of anti-access forces and capabilities.
- Real time feed of information with target-solution-level data
- Ability to defeat D&D capabilities and the ability to "locate, tag, and track" remotely and constantly
- Over the horizon comms to support targeting
- Ability to integrate IFF and combat ID to reduce potential for fratricide
- **Lack of ability to dynamically re-task fires (real time targeting, adaptive/enroute mission planning, C2) - Ship based**
- Requirement to co-develop technology and procedures for real-time deconfliction of targeting
- Require ability to support time-critical strike
- Develop procedures to transition from national detection capabilities to local supporting fires
- **Requirement for Non-lethal weapons**
- **Requirements for the type of Naval ordnance (HE, Smoke, Illum, Other) for STOM**
- Commonality of ordnance between ship-based and ground-based ordnance (logistics and sustainment issue?)
- Need to look at commonality of fires systems both Army-Marine and Marine-Navy to ensure commonality of effects and ability to sustain volumes of fire
- HIMARS storage and shipboard commonality
- Need for BOTH precision and volume (cost AND effects issue) fires

- Require ability for stand-off weapons to have target recognition capability to achieve terminal effects
- **Fire support for MCM operations**
- Define the "fires requirement" – includes the ability to employ "electronic fires" (false signatures, EW) to spoof and deceive an adversary to employ his assets in the "wrong" place
- Need to be able to employ fires to strike multiple targets within the maneuver box (LPZ etc) from same system simultaneously
- **Deficiencies in the AF's attack resources - both organic to MEB and ship based (range, lethality, logistic supportability, mobility, time of flight)**
- Require the ability for time of flight to be automatically planned into fires requests, especially on time critical strike and targets of opportunity in support of the maneuver commander on the move
- No ability for underway replenishment for Tomahawk – fire support can only reload in port
- Need for a UCAV – strike vehicle
- Require more efficient capability to reallocate and resupply indirect fire systems
- Require capability to employ ship-based fire in the counterbattery role
- Develop capability to integrate ashore targeting and tactical action to support force protection for the afloat forces (e.g., use forces ashore as stand-off systems against threats to shipping)
- AMCM and SMCM platform protection

Vignette 2

- **Inability to maintain and disseminate a common tactical picture**
- Requirement for real time feeds from sensors to tactical units
- **Require systems to increase the survivability of the MV-22 (armed escort, stealth, route planning, decoys)**
- Vulnerability of the vertical assault force outside the range of NSF weapons
- Ability to perform extended time and depth SEAD – weapons and doctrinal challenges
- Situational Awareness suite in MV-22 to increase survivability of the Vertical Assault force
- **Deficiencies of the NSFS attack resources (range, time of flight)**
- Real time/dynamic deconfliction of fires
- **Requirements for the type of ordnance (HE, Smoke, Illum, Other)**
- Need for area denial weapon that does not impede STOM maneuver
- Non-lethal weapons systems
- Require enhanced warheads with dial-an-effect to dynamically modify effect on target and reduce number of unique type of munitions that must be maintained

- Battlespace geometry and fire support coordination measures to support non-linear, simultaneous ops – Do we require for deconfliction or are they restrictive – need FSC measure that support EMW – do they support operations?
- Deep Underground penetrators and thermobaric weapons
- **Deficiencies of the MEB's attack resources (range, logistical supportability, mobility)**
- Extended range operations for fire support – organic, 24/7, all-weather coverage for sustained operations ashore
- **Lack of ability to dynamically re-task fires (real time targeting, dynamic/enroute mission planning, C2)**
- **Requirement for combat ID in all four environments (Air-Air, Air-Ground, Ground-Air, Ground-Ground)**
- Composite, fused combat ID that draws on all sensor systems that feed the system
- Require integration of existing systems and processing of information on the common system to aid in developing the CROP
- **Precision capability of MEB Fires**
- Require the ability to target and task weapon systems that are usually reserved for high value/high pay-off targets at the tactical maneuver level
- Non-traditional, non-kinetic weapons with lethal capability
- Require the ability to task and employ other Service's loitering weapons and access other joint fires while enroute and in operation
- Force protection – afloat – require onboard and off-board countermeasures
- Protection from "swarm" – provide "close-in sea control"
- COMSEC vulnerabilities – require low probability of intercept for all transmissions AND ability to encrypt data

Section 7: Red Cell Observations

The Red Cell began their work developing their strategic and operational goals in the given scenario. They did not tailor their goals or plan to the specific Red Adversary in this game. They modeled a generic non-peer competitor relying on an anti-access campaign. They then developed a commander's intent for the operation and developed approaches to counter the Amphibious Force's C4ISR and Fire/Maneuver capabilities. Finally, they assessed Red's own core capabilities and weaknesses. This overview is presented below.

Red defined their strategic goals as regime survival and the denial of US hegemony in the Persian Gulf region. To support these strategic goals, they sought to deter US military intervention in the Strait of Hormuz, and if deterrence were to fail, to inflict sufficient casualties on the MEB to force the US to withdraw from Red soil and the Persian Gulf region. Red focused defensive efforts on the protection of WMD, air defense, and C2 assets. The defeat of RLAM/RLP forces was also an operational goal. During the second vignette, Red also focused on the goal of interdicting US lines of communication (LOCs).

The Red Commander's intent was to extend the conflict by trading space for time and casualties. The Red commander did not intend to offer decisive engagement with MEB forces, to mass his forces, nor to offer lucrative targets. Red would attack to cause mass effects, particularly attacking soft targets with potential for numerous casualties, slowing or complicating MEB maneuver, C2, and Combat Service Support. Red intended to employ anti-access capabilities selectively—MANPADs, mobile SAMs, mines, ASCMs and small boats. Red desired to confuse the operational picture by seeming to be everywhere and mixing civilian and military assets, conducting Information Operations to deny/degrade MEB information and creating an information management dilemma.

Red sought to counter the MEB's advantages in C4ISR by making the MEB commanders doubt their own information (information denial, overload and corruption) and creating an uncertain and confusing operational picture. Specific methods that Red would employ include:

- decoys (mines, Command Posts, ASCMs, false emitters, etc),
- Camouflage Concealment and Denial (CCD),
- deception,
- intrusion,
- spoofing,
- disinformation,
- jamming (GPS, fires & C2 nets, etc) and
- selectively attacking key Blue C2/ISR nodes.

Red planned to use the following methods to counter the MEB's advantages in Fires and Maneuver by selectively hindering access and complicating MEB targeting and maneuver:

- minimize signatures and maximize targets/decoys by "hugging" civilians,
- attack/degrade the MEB's sensors (particularly UAVs),

- spread MANPADs, RPGs and mobile missile platforms across avenues of approach to engage AAAVs, MV-22s, LCACs, and helicopters,
- use mines, decoys, and small boats mixing with civilian craft to channelize, restrict, and complicate MEB maneuver,
- focus capabilities and fires against high payoff targets to inflict casualties and thereby delay and contain MEB forces - MEB C2, retransmission (relay) sites/platforms and sensor shooter links will be targeted,
- use unconventional forces against MEB rear area and LOCs, and
- reserve the flexibility to use defensive WMD within own sovereign territory (possibly pre-emptive).

Red assessed its core capability as its ability and willingness to employ mines, MANPADs and RPGs and to present multiple, small, mobile targets. Red would utilize complex terrain and present a constant threat to the MEB's C4I system. Red evaluated its own weaknesses as the inability to effectively command and control its forces, its lack of capability to effectively resupply forward forces and the inability to mass forces.

The Red Team evaluated the entire list of issues from both vignettes to determine those MEB shortfalls that, if corrected would provide the greatest capability to the MEB and pose the greatest problem to Red. As noted earlier, all of these issues were included in the Blue team prioritized list of major shortfalls. The number in parentheses indicates the priority this particular shortfall was assigned in its respective Blue breakout group.

Improved Network Architecture (ISR #4). The operational intent of the Red commander is to make the MEB doubt the quality of their data/database, create uncertainty and a confusing operational picture, complicate MEB targeting, and hinder access selectively. MEB Improvements in the area of network architecture will greatly deter Red's ability to pursue these objectives.

The Blue capabilities that concern Red are the ability to fuse and correlate data, the increased ability to manage information and the ability to operate with greater degrees of encryption.

The result of this added capability for Blue is enhanced situational awareness and decision-making and a greater ability to maneuver, employ fires, and provide force protection.

The Red cell provided a warning regarding the future development and employment of an improved network architecture. The network should be secure from intrusion and have a low probability of intercept. In this scenario, Red had developed a capability for offensive information warfare. A network that can be intercepted and intruded upon leaves open the vulnerability of having information and data manipulated or compromised. Red also offered the recommendation that the network be redundant to avoid the design of single points of failure that can result in the overall failure of our information flow.

Responsive Targeting & Taskable Firing System (Fires #4). The operational intent of the Red commander is to complicate MEB targeting.

The Blue capabilities that concern Red are the shorter reaction time for fires and the dwell time of target acquisition sensors.

The result of this added capability for Blue is that Red's mobile and relocatable targets are held at risk, the effectiveness of Red CCD is diminished, and Blue has increased capability and flexibility in fire support relationships and fire support coordinating measures.

Red offered the warning (from the Blue perspective) that in the development and employment of future systems and procedures we not sacrifice accuracy for speed. The precision of our weaponry, even if not fast enough, is a major advantage of the US military over many of our current and potential foes. A more responsive system must bring those precision fires to bear more quickly in the targeting cycle.

Assured Access (Maneuver #1). The operational intent of the Red commander is to complicate MEB maneuver and to selectively hinder access by the employment of an integrated anti-access strategy. This will include the use of sea mines and obstacles to deny maneuver space and channelize ship-to-shore movement, the use of land mines and obstacles to achieve the same goals ashore, and the use of small boats to attack shipping and landing craft to disrupt movement and attrit the landing force. Small, portable weapons (RPGs, MANPADS) will be employed in mass to provide both targeting dilemmas to the attacker and to selectively attrit maneuver forces. Anti-ship weaponry deployed from hardened sites will be utilized to keep supporting shipping at a distance.

The Blue capabilities that concern Red are the ability to rapidly detect and identify mines and obstacles (especially if done covertly). The Blue capability to breach mines and obstacles is not evaluated as critical by Red. Red sees the major advantage of a minefield or obstacle belt as a delaying and denial mechanism due to the uncertainty that is generated by the unknown danger area. Thus a capability to detect and identify the boundaries of a danger area, allowing a force to safely by-pass the danger area, causes Red greater concern as it negates the delay and denial that the uncertain danger area provides.

The result of this added capability for Blue is that it negates the Red barrier plan, it extends the required Red defenses, and improves the MEB maneuver options.

Red warns that we need to address access threats to other platforms (LCAC, MV-22). Red sees the focus of our concern in Red threats to Blue shipping. The smaller craft present both a greater quantity and a more vulnerable, unprotected target. The Force Protection capability addresses this threat.

Identify, Classify, and Shoot Multiple Small Targets (Vignette 2, Maneuver #4). The operational intent of the Red commander is to create uncertainty and a confusing picture and to complicate MEB targeting.

The Blue capabilities that concern Red are the ability to detect targets prior to entering Red engagement range, the ability to distinguish between combatants and civilians, the ability to process and disseminate quickly in order

to rapidly engage multiple targets, and the development of a network so any shooter can fire, regardless of acquiring sensor.

The result of this added capability for Blue is improved force protection and a reduction in collateral damage.

Non-Lethal Weapons (Vignette 2, Maneuver #4). The operational intent of the Red commander is to complicate MEB targeting and create uncertainty.

The Blue capabilities that concern Red are NLW use as barriers and layers in a perimeter defense; not as concerned about the effects on individuals.

The result of this added capability for Blue is a decreased MEB ROE concern about harming civilians, removing the doubt from the decision to fire, and reducing the utility of Red using civilians as cover.

ISR Supporting Precision Maneuver (Maneuver #2). The operational intent of the Red commander is to create uncertainty and a confusing picture and to channelize, restrict, and complicate MEB maneuver.

The Blue capabilities that concern Red are long dwell time of sensors and dissemination of quality information to lower tactical levels.

The result of this added capability for Blue is a degradation of Red's CCD ability and improved effectiveness of MEB fires, maneuver and force protection.

OTH/BLOS Tactical Communication Relay (C2 #1). The operational intent of the Red commander is to complicate MEB targeting, to operate beyond the reporting range of MEB sensors, and to force the MEB to rely on non-organic sensors. Red sees the non-organic sensors as being very effective, but not always available to the MEB commander, or not as responsive in providing data to the MEB commander in a timely manner.

The Blue capability that concerns Red is the extension of OTH/BLOS communications throughout the AO.

The result of this added capability for Blue is an improvement in maneuver, fires, C2 and force protection, the extension of the effective range of organic fires, more efficient use of sensors, and a more effective deep battle at all levels of command.

Red offers the warning that the relays to extend communication OTH should be difficult for Red to detect and attack or they should be expendable. Red will certainly target these relays and destroy them to isolate forward elements. Red observes that these relays should be redundant; multiple relays must be in effect to ensure OTH connectivity to forward forces.

Section 8: Aggregation of Shortfalls

The analysis of issues and development of descriptions of capabilities within the breakout groups yielded a redundancy of requirements and in many cases, a description of a desired capability that easily described several discrete systems. This section aggregates similar systems and separates those systems that are discrete. In conducting this aggregation, the 23 capabilities that were produced by the breakout groups is now consolidated into 18 capabilities that are more system specific. Appendix H provides a table that maps the issues presented by the breakout groups into these new categories and also provides a table that illustrates the frequency with which the specific system was identified in the breakout groups.

System	Description of Capabilities
STOM C2	• Transmit information to all maneuvering units. • Update all adjacent units of modifications to plan. • Update of fire support plan to all units. • Timely identification of surface craft, other blue forces (with frequent refresh to indicate changes in closely located maneuvering craft). • The ability to dynamically change the execution plan while underway and transmit that plan to the command ship and other craft in the local area is a requirement for STOM operations. • Real time capability. • Compatible to the individual craft/vehicle level. • Space and power constraints.
OTH/BLOS Tac Comm Relay	• Extend range of JRTS to OTH. • Redundant systems. • Focus on Battalion and below – interoperable with JRTS. • Effective from over the next hill out to a range of 400nm. • Should not require terrestrially based infrastructure (relay sites, etc) that require additional manpower which will increase force protection and security requirements. • Must not be satellite-based.

IM/Decision Support Tools

- Provide CROP to all levels
- Identify, prioritize, filter, fuze, and display information in a manner that will facilitate decision-making.
- Tailor information to meet the specific mission needs of a variety of units, both large and small.
- Must be able to sort web-based and non web-based data
- Software must have re-routing and self-healing capabilities.
- Focus on those tactical units battalion-sized and below.

Data Flow Optimization

- Use available bandwidth more efficiently.
- The bandwidth associated with the networks servicing lower tactical units must be right-sized and optimized in order to increase the overall effectiveness of the network.
- Development of network management tools to allow commanders to set message priorities, while designing self-healing and routing networks must be pursued.
- Efforts must be expended to ensure the to-be developed JTRS is as capable as possible.
- Compress or reduce the “appetite” of some of our tactical applications that run over the network.
- Establishment of one network composed of many sub networks. Future networks will most likely move away from dedicated nets to support individual battlefield functions (intelligence, fires, etc.).

Remote Unmanned Sensor

- Detect surface and submerged mines and obstacles (sea)
- Detect surface and buried mines and obstacles (land)
- Detect and track mobile contacts
- Detect humans in concealed positions
- Detect explosives, CBR (sniffer)
- Detect non-metallic mines.
- Detect and track small maneuvering targets (sea, air, land)

- Unmanned and/or standoff systems are preferred for covert discovery.
- Graphical and audible display of information should be explored with a scaleable window.
- Real-time feed.
- An aging feature (frequent enough to reflect change with the ability to indicate change – or lack of change – of items of interest on display).

Personal ISR Package/Target Locating Device

- Small, hands free
- Provides ISR to and from individual
- Links targeting info from individual to shooter
- Securely send/receive digital image, motion, multi-spectral information.
- Securely send/receive location (GPS).
- Securely send/receive lazing information for target (identification, classification, designation, location, and dissemination) and connect with unattended sensors.
- Burst transmission is required to reduce signature.
- Ability to do OCR scanning for captured documents.

Organic UAV

- Entry to a non-permissive environment from the near offshore.
- Capable of operating from ships and austere runways; VTOL preferred.
- Developed to operate as an ISR platform in urban environments.
- Ship-launchable and ship-recoverable without impacting ongoing flight operations.
- Medium range (minimum of 250 miles) - bridge the gap between Dragon Warrior and Global Hawk.
- Minimal footprint for a ground station.
- Capable of “tracking while hovering or orbiting”.
- Interchangeable, modularized sensor packages optimized for the particular mission.
- Operating parameters must be developed to be compatible with sensor packages.

Network Architecture/ Netted Fires

- Linked network
- Reach back and access to all data
- All fires and sensors netted together
- Ability to tie in sensor, C2, and engagement platforms and systems across the battlespace.
- Weapon/target matching and target deconfliction with the ability to create an automated sensor-to-shooter engagement architecture.
- Network must be supported by over-the-horizon comms.
- Sensor interoperability and cross cueing.
- Should have built-in capability to conduct data tagging, sanitization and filtering of data.
- It should possess satellite-selectable encryption levels.
- It is preferred to operate in the HF spectrum.

Mine Breaching/Clearing

- Breaching of sea and land mines.
- Lane marking.
- From LD throughout the sea and land maneuver space to designated objectives ashore.
- The system must ensure that MEB elements can maintain op tempo, momentum and unimpeded maneuver.
- Ability to rapidly bridge obstacles, ditches, and bridges is required.

Force Protection Non-Lethals

- Remote deployment to establish boundary on ship and craft.
- Selective non-lethal to target explosives and arms; directed energy, or similar technology, to create a detonation, or disrupt the electronics within the propulsion system on the threat craft.

Decontaminant

- Neutralizing agent.
- Can be expediently applied before LD
- Less resource intensive method of decontamination.
- A waterless method is needed for forward decontamination when logistics support is limited.

- System that is developed to deliver this method of decontamination must be lightweight and portable (HMMWV transportable).
- The objective for this capability is the rapid restoration of combat power and the ability to re-deploy to Amphibious Force (AF) shipping.

Adaptive Mission Planning System

- System to build STOM maneuver.
- Air and surface craft integrated into same plan.
- Can evaluate fuel expenditure, time, and reliability.
- Development, rehearsal, and integration of landing plans.
- Requires full integration of other systems and relevant databases including ISR, environmental, threat, etc.
- Ability to simulate plan execution and rapidly adapt the plan to accommodate changes in the tactical situation.
- Rapid means to examine courses of action (COA) and conduct detailed planning to support selected COA.

ITV

- Improvements to existing program
- Transport "heavy" items once inserted into a LZ and provide enhanced mobility to the vertical assault forces.
- Rapidly load, secure, release, and offload from the inside of a MV-22.
- Capability to tow the EFSS and transport the control stations for unmanned vehicles.
- It must be capable of fording.
- The capability to operate with multiple types of fuel or alternate power sources is desirable.

EFSS Enhancements

- Transportable with ITV as prime mover for vertical assaults, internally transportable with an ITV in the same MV22.
- Transportable with a LAV, AAAV, or HMMWV as prime mover for surface forces.
- Increase in the range of the system, and small but common munitions.

Ashore Counter-battery

- Ability to detect, acquire and fix threat indirect-fire
- systems' locations (360 degrees) at the range of threat weapons.
- Employing a light, portable system capable of operating on the move and transitioning ship-to-shore and transmitting target locations to the counterfire network.
- Small, efficient power supply, small size, computing power to target in less than 3-D, and man-safe operations.

Reduce “cost” of Fires

- An extended range munition (beyond the range of ERGM) that can be fired in volume.
- A size and weight less than current ballistic rounds.
- Adjustable "yield/effect" capabilities that can be fired from sea-based platforms.
- This system must fire ammunition sub-components (explosive filler, guidance systems, and fusing) that possess commonality and a reduced cost guidance systems must be developed to support volume fires.
- Compatible with naval fire systems, decreasing the burden on magazines, logistic systems, etc.

Loitering Munitions

- Reduces the time from acquisition and targeting to arrival of ordnance.
- The system must be a reduced Time-of-Flight (TOF) weapon that still achieves the effects required by the MEB commander to address both precision and volume fires.
- It must possess station time to ensure duration coverage, dwell, and ability to assess and reattack as required.
- Constant stare and dwell as well as the ability to assess and reattack as required.
- Both area and point target munitions are required.

New Modular, Lightweight Mobile Weapons System

- One fire support system replacing multiple systems.
- Internally transportable by MV-22.
- Capable of achieving the effects of all indirect fire systems currently organic to the MEB with mobility comparable to maneuver units once deployed.
- Capability must reduce the footprint ashore and must address logistics, interoperability and compatibility issues.
- Removes the layers that current multiple fire support systems present.
- Provide less complication to the targeting process and increases interconnectivity issues and Fire Direction Center coordination/target deconfliction.

Section 9: Results of Technology Panel

The Technology Panel reviewed all 23 issues that were forwarded from the Expeditionary Maneuver Warfare War Game. The panel conducted a free form discussion, which met the objectives the FNC had presented at the beginning of the panel. These objectives included:

- Warning the FNC team of pitfalls to avoid (capabilities where a lot of money is already being spent, where FNC dollars would be insufficient to make a difference, and where good money has been spent after bad)
- Identifying opportunities for the FNC to exploit where it is worth spending FNC S&T dollars and where FNC can leverage ongoing work
- Calibrating FNC expectations – a reality check
- Helping the FNC management determine how best to communicate the S&T requirements to industry, labs and universities.

The major theme that the panel reiterated was that the highest payoff technologies to pursue were in the C2 and ISR areas. Even the shortfalls identified in the Maneuver and Fires enabling capabilities could best be addressed, within the constraints of the FNC charter, by improvements in the C2 and ISR support to these operational capabilities. Improving the Common Relevant Operational Picture and enabling Real Time Adaptive Planning for Dynamic Execution should be the focus of the S&T investment plan.
Within the C2 and ISR areas, the highest payoff S&T investments would be in the integration of existing systems and the leveraging of ongoing commercial and military programs. The panel stressed that the FNC should avoid pursuing any issue that would generate a new Program of Record (POR)

In the C2 area, the panel recommended that the FNC should try to leverage the existing national laser communications program headed by Lee Hammerstrom, aircraft conformal antenna array work started by Boeing, and “last mile” connectivity hardware being used in the wireless communications industry. The panel also recommended that an effort be made to determine how to establish the required databases from the population of those that currently exist as stand-alones. As with many other recommendations from the panel, this is an issue of integration of existing systems and capabilities.

In the ISR area, the panel’s recommendations centered on the “personal ISR” and “locally-controlled UAV” shortfalls. With respect to the personal ISR, the panel advised ONR to allow industry to propose what they could package into a man-portable system rather than to constrain industry to an arbitrary weight and cube. The panel also suggested that ONE coordinate its efforts with the Special Operations Command in order to leverage their developments in this area. With respect to the locally controlled UAV, the panel suggested that ONR

focus its efforts on payloads for naval UAVs, such as Dragon Warrior, rather than attempting to develop a new UAV or sensor packages transitionable specifically to an Army UAV.

In the Maneuver area, the Panel recommended that the FNC pursue the delivery of exiting mapping capabilities into the cockpits and control stations of appropriate level tactical platforms such as the AAAV, LCC and MV-22. The panel felt that modest improvements in the provision of situational awareness – where am I, where is the enemy, where are the friendly forces – could pay the most immediate dividends in increasing the survivability of maneuver forces. With specific reference to the "assured access" and "Landmines and Obstacle Breaching" shortfalls, the panel advised the FNC to first determine what the Organic MCM FNC and the Army were doing before investing LC FNC funds in this area.

In the Fires area, the panel felt the greatest potential impact the FNC could provide would be in the area of integrating existing stove-piped systems into one network. – "netted fires".

The panel specifically recommended some technologies not be pursued. These included the following:

- Chem/Bio decontamination: By law, all Chem/Bio defense must be sponsored by the Joint DOD office. Any dollars the FNC invested would, at best, be absorbed by that office.
- Non-lethal Weapons: The Joint Non-Lethal Weapons Office coordinates all non-lethal programs in DOD. As with Chem/Bio technology, FNC funds would not survive.
- "Cost" of fires: The panel sited a long history of failed S&T programs and the ammunition acquisition tail is too large.
- Modular, lightweight mobile weapon system: This identified shortfall envisioned a generic new system as a solution. This would be a new program of record, and, therefore, outside the scope of the FNC.
- Ashore counterbattery: Nothing in the FYDP satisfied the requirements to solve this shortfall. This would be a new program of record, and, therefore, outside the scope of the FNC.

Appendix A: List of Participants

Gen Wilhelm	Senior Player
RADM Whisler	Senior Player
MGen Stanley	IPT Co-Chair
Mr. Belen	IPT Member
BGen (Sel) Paxton	IPT Member
BGen Catto	Vice CNR
Dr Shoup	OPNAV N75
Mr. Kapos	ONR
Col Blaisol	MCCDC
Mr. Bob Smith	OPNAV N911
Mr. Simpson	USMC War Gaming
Mr. McMains	ONR
Mr. Simons	ONR
Mr. Turley	Guest
CAPT Nickle	HQMC
Mr. O'Leary	PM, LC FNC
Mr. Blumenthal	Deputy PM, LC FNC
Mr. Wurzel	Arete Associates
Ms. Herbert	Arete Associates
Col Thompson	MCCDC
Mr. Markowitz	CNA
LtCol Ingram	OMCM FNC, ONR
Mr. Anderson	NWDC
Mr. Vann	NWDC
Mr. W. Smith	NWDC
Mr. Allison	MCWL

Breakout Group Assignments

Maneuver Group

Col Lockard	GCE Advocate
LtCol Hayn	ACE Advocate
LtCol Siniff	ACE Advocate
LtCol Regner	CSSE Advocate
Maj Wright	CE Advocate
CAPT Rowland	OPNAV (N753)
CAPT Robey	Naval Coastal Warfare Group One
LtCol Burns	NWDC
Maj Stanton	MCCDC
Maj Barber	MCCDC
Mr. Campbell	ONR LC FNC
Ms. Thibault	CNA
Mr. Rauch	ONR LC FNC
Mr. Reece	Arete Associates

Fires Group

LtCol Kleinsmith	GCE Advocate
Maj Annichiarico	ACE Advocate
Capt Flanagan	CSSE Advocate
LtCol Langley	OPNAV (N75/N76)
CAPT Johnson	OPNAV (N76)
LCDR Burian	NWDC
LtCol Kerl	MCCDC
LtCol Hannay	MCWL
Mr. Wisniewski	ONR LC FNC
Ms. Williams	ONR LC FNC
Ms. Ezring	CNA
Mr. Garvin	ONR LC FNC
Mr. Haselton	Arete Associates

ISR Group

LtCol Kyser	GCE Advocate
Mr. Vogel	ACE Advocate
LtCol Lang	CE Advocate
CAPT Davilli	OPNAV (N752)
Mr. Gaffney	OPNAV
LCDR Morlock	NWDC
LCDR Rowe	NWDC
CDR McNiven	ONR LC FNC
Maj Loyd	MCCDC
Capt Judd	MCCDC
CDR Lasky	OPNAV
Mr. Csontos	CNA
Mr. McGillicuddy	ONR LC FNC
Mr. McGruther	Arete Associates

C2 Group

LtCol McKinley	GCE Advocate
Maj Loftesnes	ACE Advocate
Mr. Linkowitz	CSSE Advocate
LtCol Ziegenfuss	CE Advocate
CDR Schaefer	OPNAV (N753)
CDR Switick	NWDC
Maj Riley	MCCDC
Maj Cancellier	MCCDC
Mr. Dingess	MCCDC
LtCol Barth	MCWL
LtCol Kuntz	MCCDC
Mr. K. Smith	MCSC
Mr. Elwing	HQMC
Ms. Magwood	CNA
Ms. Shearer	ONR LC FNC
Mr. Dobson	Arete Associates (Anteon)

Red Group

Mr. Lyons	CNA
Mr. Gangle	CETO
Mr. Caldwell	CETO
Mr. D. Smith	CIA
Mr. Murray	Arete Associates

Appendix B: Scenario Description and Background

Tab 1. Description of scenario and vignettes.

Tab 2. Game Proceedings.

Tab 3. Baseline 2010 MEB.

Tab 4. Scheme of Maneuver and Task Organization for vignette 1.

Tab 5. Scheme of Maneuver and Task Organization for vignette 2.

Tab 6. Road to War.

Tab 7. Naval Force Laydown.

Tab 8. Establishing Directive and Pre-Game Actions.

Tab 1. Description of Scenario and Vignettes

Vignette One was developed to require an amphibious assault in a non-permissive environment. MEB and RLT headquarters remained afloat. Fixed-wing aviation remained land-based in a third country while rotary wing aviation was sea-based. There were three maneuver elements – two airlifted reinforced infantry battalions and one surface-landed mechanized reinforced infantry battalion. Units were operating at distances in excess of 100 miles from the sea-based MEB Headquarters.

Vignette Two began with the MEB and the RLT headquarters ashore. Fixed-wing and rotary-wing aviation were shore-based. The vignette included two major elements, an extended movement to contact and the establishment and operation of a forward operating base (FOB). The RLT moved approximately 300 miles (road distance) inland. The MEB HQ and the rotary-wing aviation displaced to the FOB base some 170 miles (air distance) inland.

The scenario was based upon an integrated anti-access strategy employed by Red to support closure of the adjacent straits to shipping and to deter US military intervention in the Straits. The integrated anti-access strategy employed by Red included the emplacement of sea mines in the Straits; the use of small boats to attack landing craft and, if the opportunity arose, to attack US warships. Red built an integrated system of fixed and mobile systems that included mobile and hardened anti-ship cruise missile (ASCM) sites; mobile anti-air missile batteries and man-portable Surface-to Air Missiles (MANPADS); and dispersed armor infantry and artillery. Red possessed a mature capability to employ chemical and biological agents.

An additional factor introduced into the scenario was a resistance movement that was given the title of Red Liberation Party (RLP) and the armed movement associated with the political entity, the Red Liberation Armed Movement (RLAM). These organizations are loosely based on current movements that are active in Red and the grievances that form the basis of their resistance to Red are actual foundations of the groups today. This factor was introduced to provide play for US Special Operations Forces (SOF) in the role of advisors to the resistance and to evaluate the interoperability of MEB forces with SOF.

US forces in the region were designated with assumptions for their activity. USAF continued to be based in Saudi Arabia and UAE. SOF teams were active within Red. Joint Force activity was conducted to shape theater operations. A carrier battle group (CVBG) and a surface action group (SAG) were stationed in the Persian Gulf, with an additional CVBG and SAG in the Arabian Sea. An Amphibious Task Force was positioned in the Arabian Sea. MEB fixed wing aircraft were positioned in UAE.

The following assumptions were made for the purpose of focusing the game on the objectives:

- Red Navy surface and submarine threat have been neutralized.
- US Navy provides Area Missile Defense.

  - "Umbrella" over Landing Force during Vignette 1.
- 64 NM range for NGFS - ship to target.
- 25 sorties per day of carrier based air for support of MEB.
  - Remaining Carrier sorties dedicated to other CVBG missions.
- TLAM available for very high value targets.
- Rivet Joint, EP3 supporting MEB operations.
  - JSTARS not available for MEB operations.
- JFACC conducting shaping operations.

Tab 2. Game Proceedings

The game began with an afternoon of background briefings. The purpose and function of the LC FNC was presented to provide the game participants of the organization's purpose and the need for seeking operational expertise and experience in developing the S&T investment plan. The game purpose and design were briefed to provide participants with the timeline and desired output from each session. Emerging STOM doctrine was provided by MCCDC. This presentation provided a doctrinal and tactical baseline that gave more detailed substance to the concept paper provided in the game book. Finally, the characteristics of the baseline 2010 force were provided. This presentation focused on the Task Organization of the MEB as developed by MCCDC and a brief overview of the characteristics of the major items if equipment being fielded during the next eight years. Differences in performance and capabilities with current systems were highlighted.

The second day of the game began with the presentation of the scenario, Red and friendly force lay-down, game assumptions, and vignette one mission, concept of operations, and tactical steps. This briefing was followed by the task organizations of the subordinate elements of the MEB, outlining the area of influence and defining the distances involved for each phase of the operation, as well as indicating the range of operation if organic ISR and Fires assets. The final session of the plenary was devoted to the discussion of operational shortfalls in conducting STOM in this environment. Obvious capability shortfalls identified in previous games and studies were presented to draw attention to the shortfalls that will exist as the 2010 force conducts STOM. The players and subject-matter experts provided much greater detail and additional issues for consideration by the breakout groups. A total of 22 shortfalls were presented to the plenary for the first vignette. During the plenary discussions, an additional 94 issues were developed, resulting in a total of 116 issues to be considered by the breakout groups.

Following the plenary discussions, five breakout cells were organized to prioritize the assigned issues and develop the operational requirements for the key issues. The detailed discussions are included in following sections of the report.

The morning of the third day of the game was devoted to briefing the deliberations of the breakout cells and conducting a plenary discussion of the issues from each group. These discussions are also included in following sections. The second vignette was presented in the afternoon of the third day. This vignette assigned the mission to the MEB of attacking to defeat enemy forces in zone, establishing a FOB approximately 170 miles from the sea in order to prevent advancing armored brigades from linking up and interfering with mine clearing operations in the Strait of Hormuz. Similar to the briefing of the first vignette, the scenario, Red and friendly force lay-down, mission, concept of operations, and tactical steps were provided. This briefing was followed by the task organizations of the subordinate elements of the MEB, outlining the area of

influence and defining the distances involved for each phase of the operation, as well as indicating the range of operation if organic ISR and Fires assets.

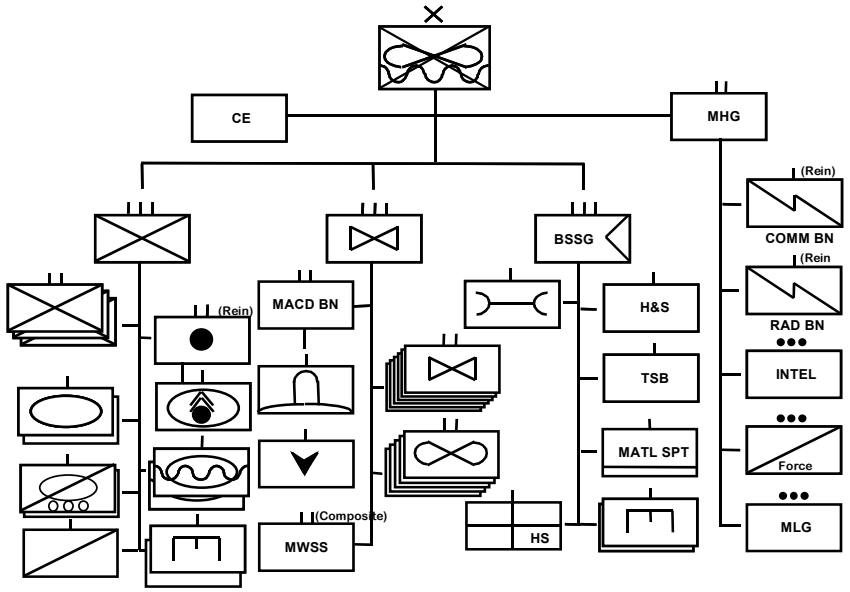
A presentation of capability shortfalls identified in previous games and studies was presented, with additional issues provided by players and participants. A total of 24 shortfalls were presented to the plenary for the second vignette. During the plenary discussions, an additional 69 issues were developed, resulting in a total of 93 issues to be considered by the breakout groups. The Breakout groups deliberated on the morning of the fourth day and presented their results during plenary session on the afternoon of the fourth day. The Red cell concluded the session with a briefing of Red analysis of both vignettes.

Tab 3. Baseline 2010 MEB

The figure below reflects the baseline Task Organization that was used for the 2010 MEB.

Baseline Marine Expeditionary Brigade 2010

Major Items of Equipment	
AAAV	106
LAV	58
M1A1	29
LW155	18
HIMARS	6
EFSS	6
TOW	36
UH-1Y	9
AH-1Z	18
JSF	36
EA-6B	5
KC-130	12
MV-22	48
CH-53E	20
Stinger	16
Avenger	16
CLAWS	12
Comm Veh	246
HMMWV	756
ITV	21
MTVR	383
LVS	101
CESE	297

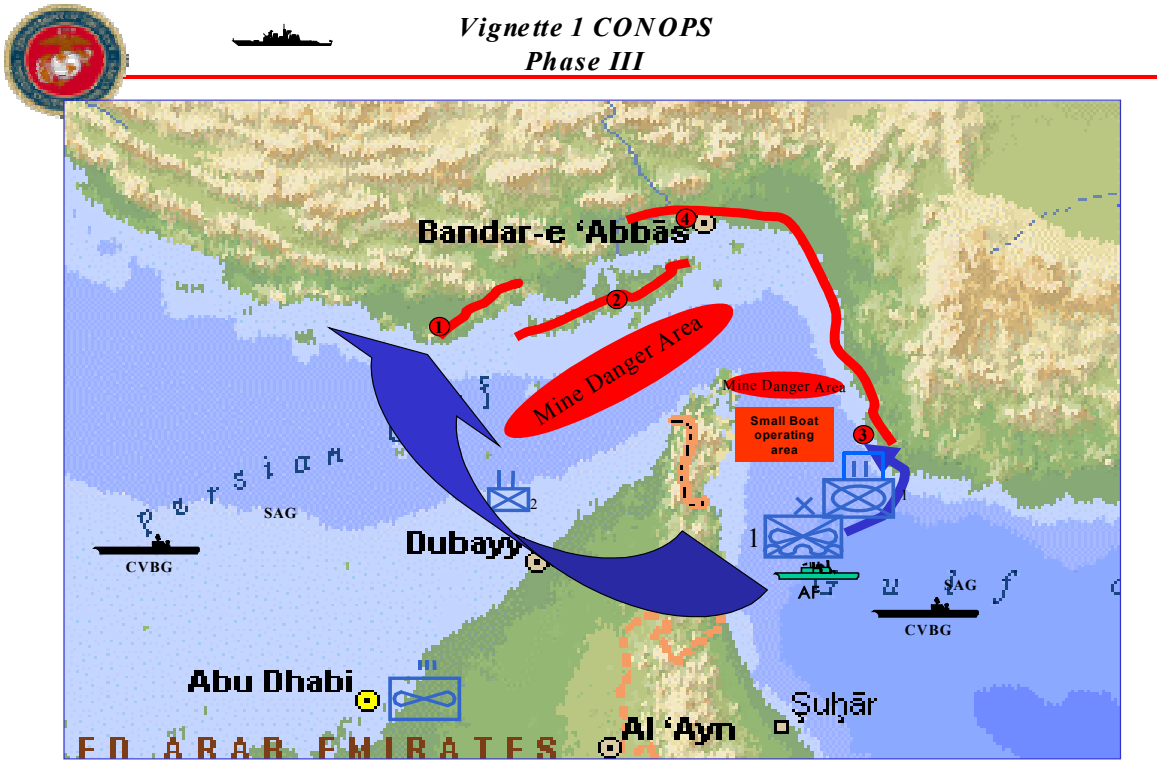


~14,276 personnel*

* Does not include NSE

Tab 4. Scheme of Maneuver and Task Organization for vignette 1

The figure below reflects the scheme of maneuver for Phase III of vignette 1.

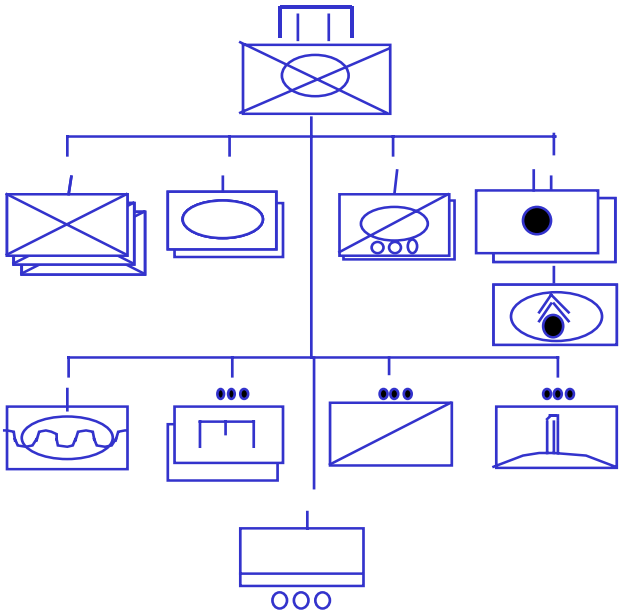


The figures below depict the Task Organizations of the two Task Forces in Phase III of vignette 1.

Vignette 1
Maneuver Task Group I (Surface)

Major Items of Equipment	
AAAV	60
LAVs	58
M1A1	29
LW155	12
HIMARS	6
TOW	8
Comm Veh	54
TUGV	3
HMMWV	127
ITV	4
MTVR	90
LVS	35
ABV	3
Avenger	8
CESE	25
Total	522

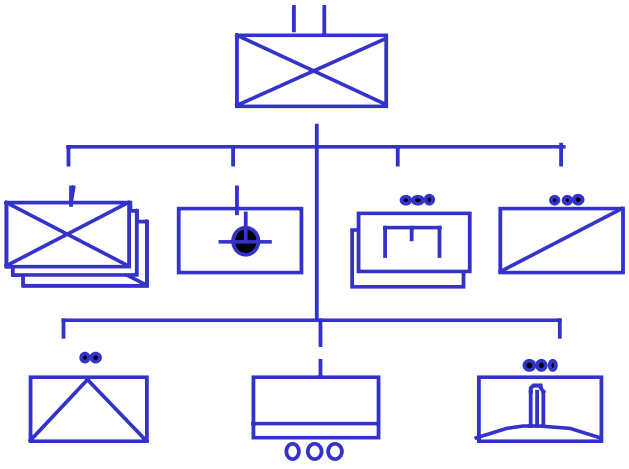
~2, 800 personnel



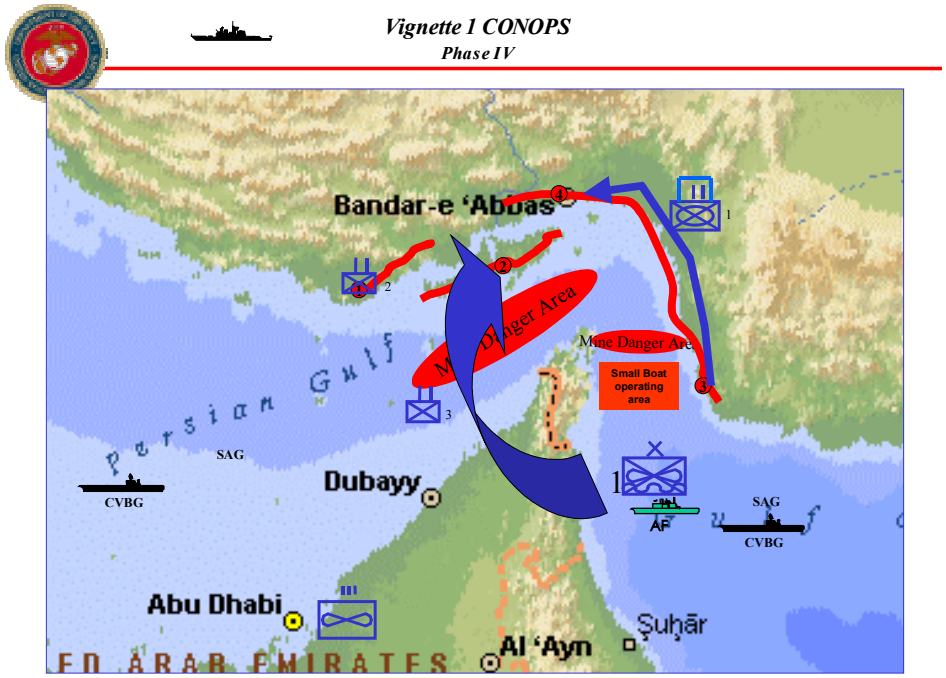
Vignette 1
Maneuver Task Group 2 (Air 1)

Major Items of Equipment	
EFSS	6
Comm Veh	18
TUGV	3
HMMWV	136
ITV	8
MTVR	35
TOW	20
Stinger	8
Avenger	4
CESE	9
Total	247

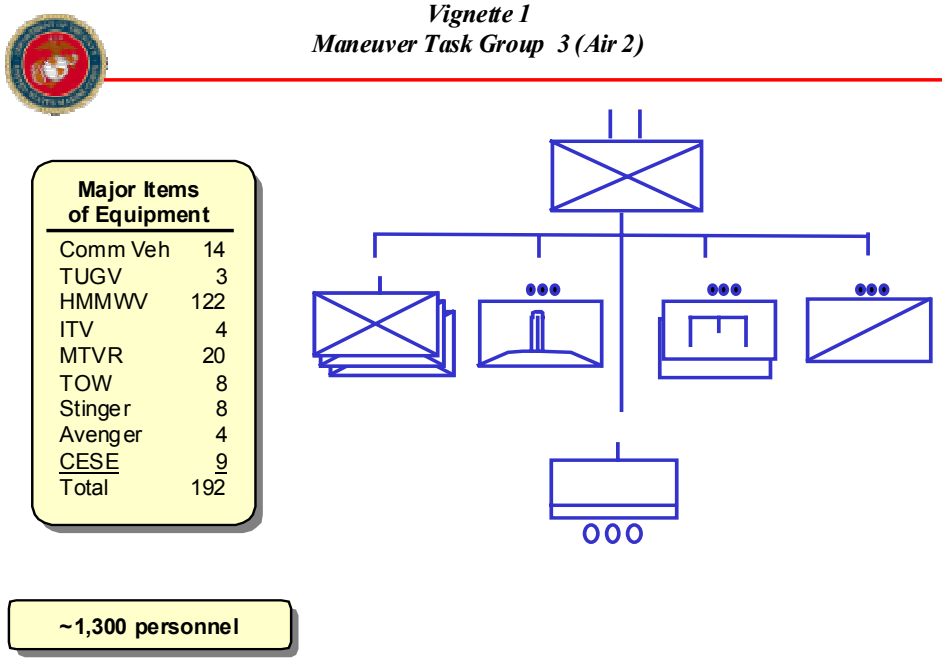
~1,400 personnel



The figure below reflects the scheme of maneuver for Phase IV of vignette 1.



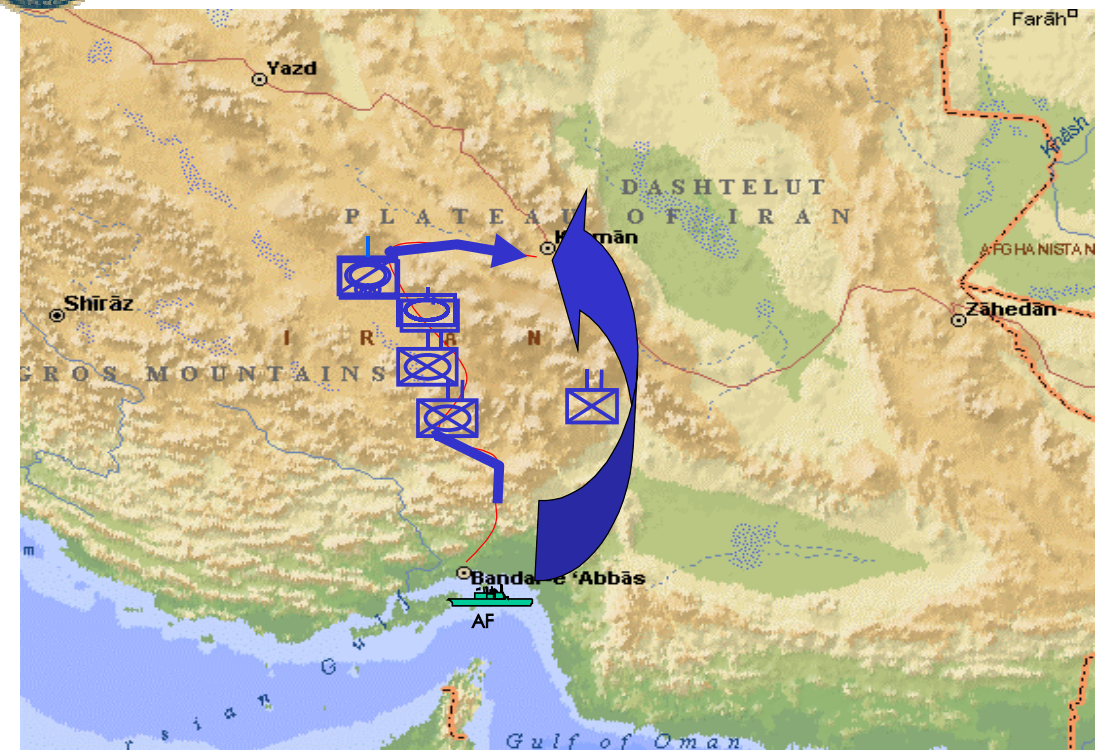
The figure below depicts the Task Organization of the Task Force in Phase III of vignette 1.



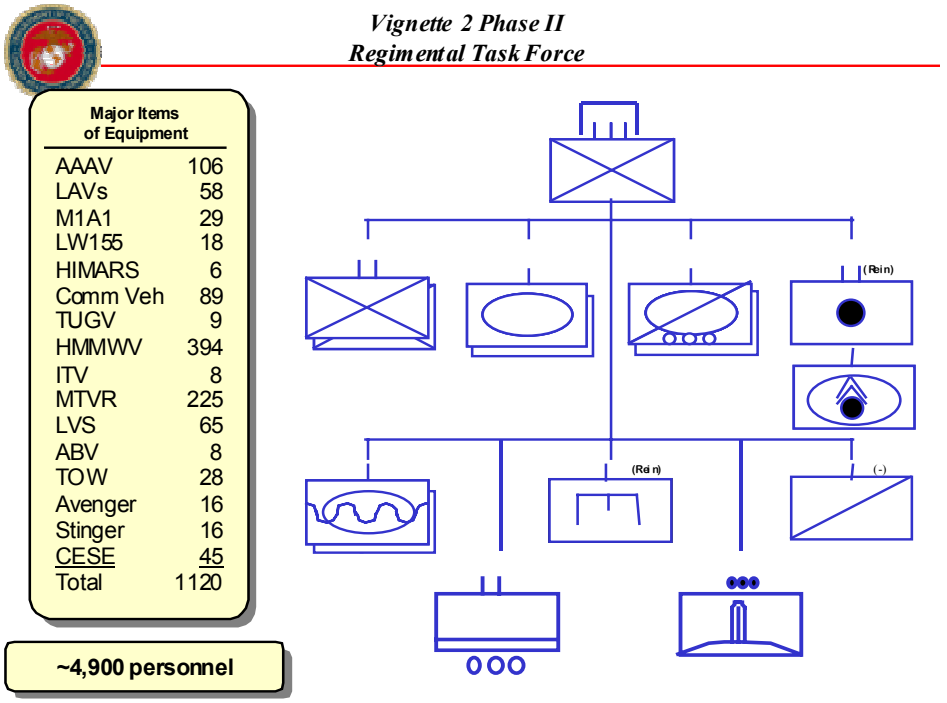
Tab 5. Scheme of Maneuver and Task Organization Vignette 2

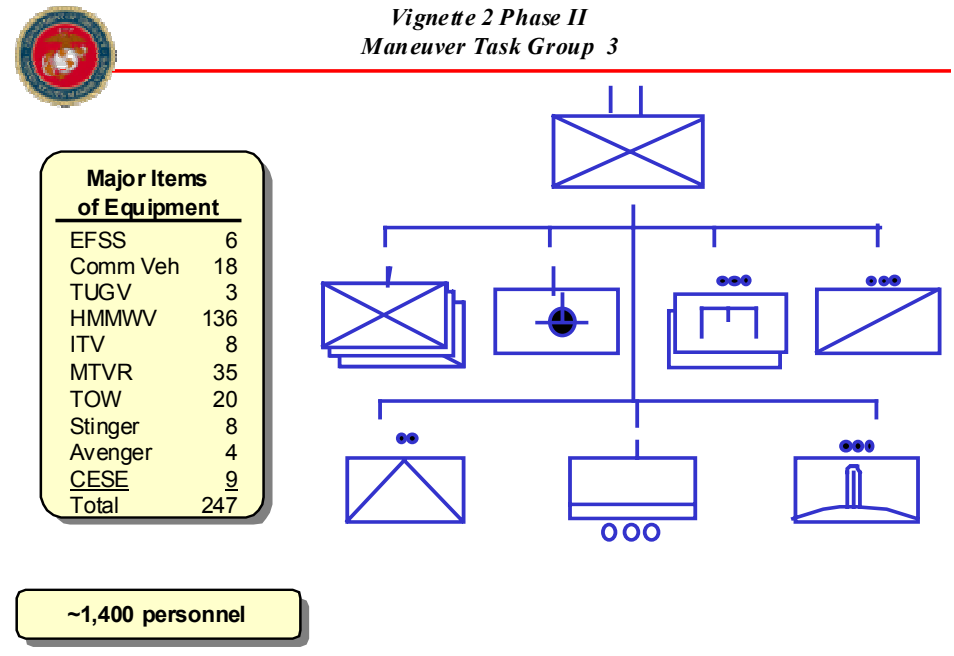
The figure below reflects the scheme of maneuver for Phase II of vignette 2.

Vignette 2 CONOPS
Phase II

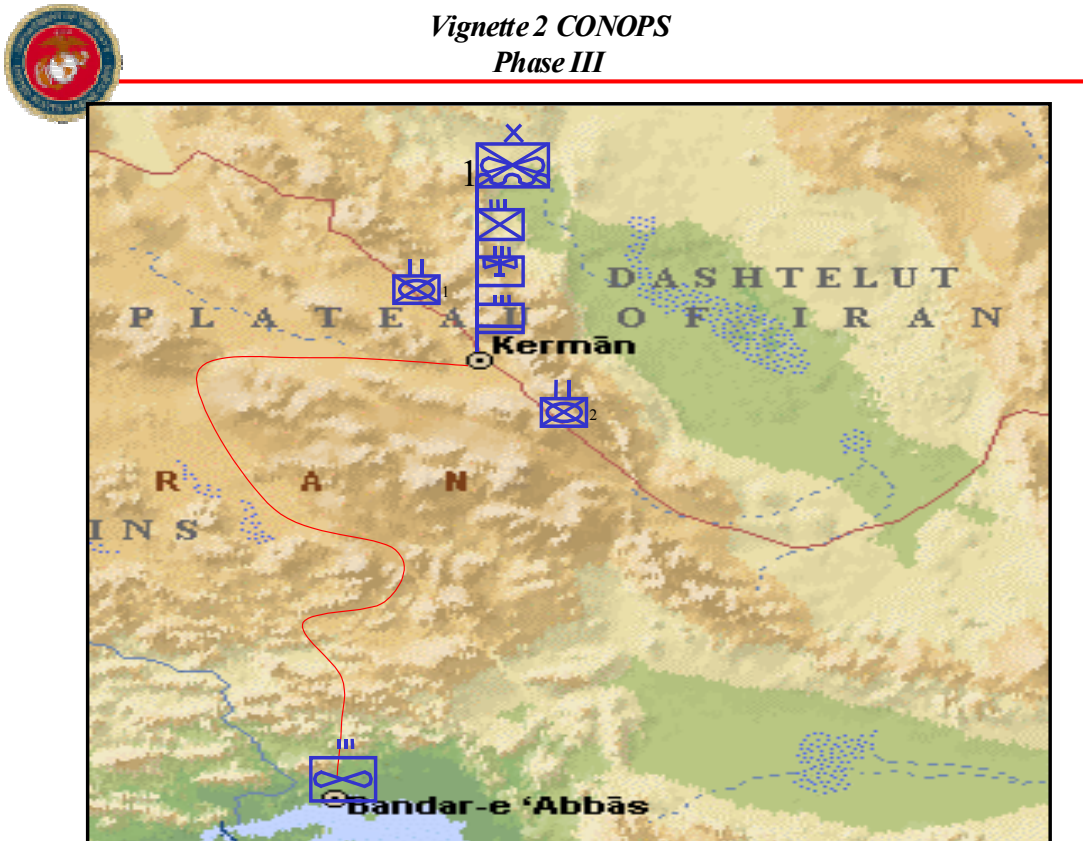


The figure below depicts the Task Organizations in Phase II of vignette 2.





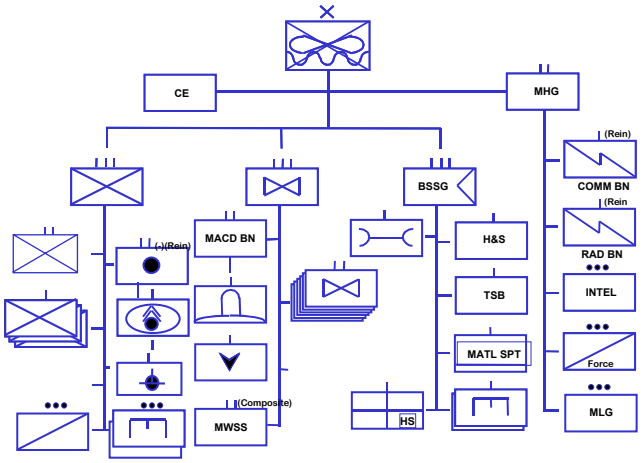
The figure below reflects the scheme of maneuver for Phase III of vignette 2.



The figure below depicts the Task Organizations in Phase III of vignette 2.

Vignette 2 Phase III
MEB at FOB Kerman Task Organization

Major Items of Equipment	
LW155	6
HIMARS	6
EFSS	6
TOW	8
UH-1Y	9
AH-1Z	18
MV-22	48
CH-53E	20
CLAWS	6
Comm Veh	132
UAV	6
TUGV	6
HMMWV	303
ITV	4
MTVR	211
LVS	45
CESE	169
Total	991

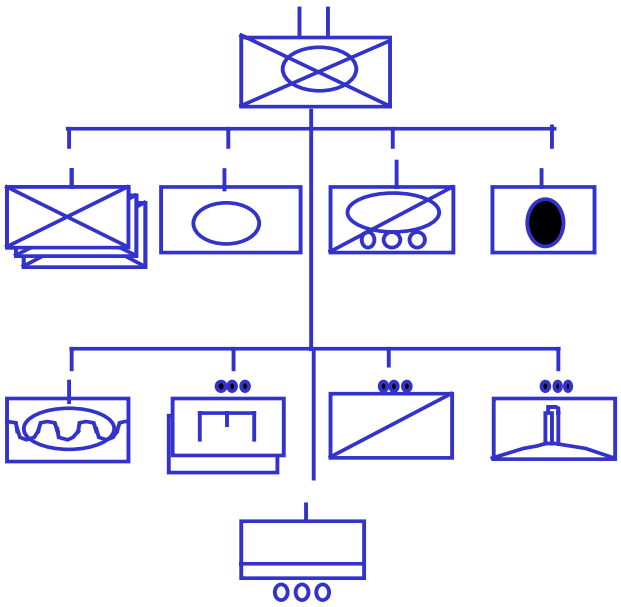


~5,700 personnel*

* Does not include NSE

Vignette 2 Phase III
Maneuver Task Groups 1 & 2

Major Items of Equipment	
AAAV	46
LAVs	25
M1A1	14
LW155	6
Comm Veh	38
TUGV	3
HMMWV	125
ITV	4
MTVR	51
LVS	18
ABV	3
TOW	14
Avenger	8
Stinger	8
CESE	15
Total	406



~2,100 personnel

Tab 6. Road to War

Since the beginning of the 21st century, the Islamic Republic of Red has been faced with a growing movement for a return to a more secular type of government that has closer ties to the West. During the early part of the decade this movement consisted of a very unorganized student movement by the younger, educated elements of the population and the secret discussions by some government officials to invigorate Red's stagnant economy. The regime tolerated informal discussion of an opening to the West, but was quick to crack down on any hint of an organized group to pursue an alternative to the theocratic form of government.

In 2006, student demonstrations began to take place in the major cities. These were initially tolerated and then vigorously responded to by local police and deployments of the Red Revolutionary Guards. Several key leaders of this student movement fled to Turkey, Afghanistan, and Saudi Arabia. Ninety Seven faculty members of major universities, fifteen managers of the petroleum industry, twenty-two local government officials and nine generals and colonels of the Red military were imprisoned as a result of a major secret police crack down on supporters and sympathizers for this student movement. Several key supporters from academia, business, government and the military were able to escape from Red before being netted in this effort.

In 2007, the Red Liberation Party (RLP) announced its foundation. Headquartered in Turkey, the RLP announced a platform of securing a multi-party system within Red, re-establishing diplomatic, economic and cultural ties with the West, revocation of strict Islamic laws and establishing a secular code of law for non-religious activities, allowing freedom of religion while acknowledging the dominance of Shia Islam. The RLP supported members and cells operating within Red to spread awareness of their position.

In 2008, leaders of the RLP were publicly greeted in Washington, DC by members of the US Senate who pledged moral support and assistance for the RLP. The RLP also established offices in Berlin, Paris, and London. A group identified as the Red Liberation Armed Movement (RLAM) became public. This group described itself as the armed wing of the RLP. The Islamic Republic of Red issued fatwas on the leaders of the RLP and vowed to hunt them down. This met with an immediate response from the United States, Great Britain, France, and Germany in individual statements condemning the threat of Red state-sponsored assassinations on Western soil.

Throughout 2008 and 2009, protests continued within Red as did brutal reaction from the government. The RLAM conducted small raids against isolated army and police posts and assumed de facto control of several small towns in the south west of Red. Leaders of the RLP continued their efforts to gain international support. Relations between the Islamic Republic of Red and the United States, Great Britain, France and Germany became strained. Red issued a warning that continued support for the RLP would be considered an act of war and threatened to close the Strait of Hormuz to all shipping from any country that supported the actions of the RLP. Ultimatums were also issued to Turkey,

Afghanistan, and Saudi Arabia with the threat of military strikes against suspected RLAM sites and training camps, as well as against political headquarters of the RLP in those countries.

All three countries deny that the RLAM is using their territory for training or staging for attacks against Red territory. They also reply that any support for Red citizens located in their country is purely humanitarian.

The United States maintains a naval presence within the Persian Gulf throughout the period to support the no fly zone in Brown and to provide an overseas presence in the region. The United States responded to the Red ultimatum by stating that any attempt to deny access to the Persian Gulf would be met with military action to reopen the Straits. The United States quietly requested the RLP to tone down their rhetoric and activities while the US sought a cooling down period.

In July of 2010, the Red Revolutionary Guards uncovered nine arms caches throughout the eastern portion of Red that contained large supplies of US made weapons and ammunition and publically declared their intent to close the straits. During August, 2010, Red begins operations to seed the Strait of Hormuz with mines, and issued threats to confiscate the cargo and detain the crews of any US ship attempting to negotiate the Strait of Hormuz. This threat was also made to Great Britain, France and Germany as a result of their continuing support to the RLP within their countries.

Tab 7. Naval Force Lay Down

Amphibious Task Force

SHIPS	**Capabilities**	
Assault Echelon		
LHD X 3	Troops	14,000
LHA X 2	Square	302,900
LPD-17 X 4	Cube	810,600
LSD-41 X 4	VTOL Spots*	235
LSD- 49 X 2	LCAC Spots	39
Total 15	* CH-46 Equivalents	

Assault Follow-On Echelon
Commercial Ships
8-10

Carrier Battle Group X 2*

SHIPS	**Capabilities**	
CVN X 2	Aircraft	
CG X 4	- F/A	108
DDG X 2	- EA	8
DD X 2	Missile Cells	796
FFG X 2	5” 54 Guns	12
SSN X 2	5” 62 Guns	2
SSGN X1 (Arabian Sea)	Tomahawk	154
	SOF	66
Total 15		

** One inside Persian Gulf & one in Arabian Sea*

Surface Action Group X 2*

SHIPS		**Capabilities**	
Inside Persian Gulf			
CG	0	Missile Cells	54
DDG	1	5” 54 Guns	4
DD	1	5” 62 Guns	1
FFG	2		
Total	4		
In Arabian Sea			
CG	1	Missile Cells	276
DDG	2	5” 54 Guns	5
DD	2	5” 62 Guns	2
FFG	0		
Total	5		

** One inside Persian Gulf & one in Arabian Sea*

Tab 8. Establishing Directive and Pre-Game Actions

Establishing Directive

1. Effective 235901July2010Z, Commander, Task Force 30 (USS Reagan Battle Group) is designated Commander, Naval Forces (NAVFOR). Assigned forces will include Amphibious Task Force 36 and 1st Marine Expeditionary Brigade (1st MEB) for transit to AOR. Commanding General, 1st MEB is designated Commander, Marine Corps Forces (MARFOR).

2. NAVFOR is the supported command from the date of this establishing directive to the arrival of the force at the designated Line of Departure in the Gulf of Oman. MARFOR is the supporting command.

3. Upon arrival at the Line of Departure, MARFOR becomes the supported command. NAVFOR is the supporting command. This arrangement continues until all MEB assets have completed back-load onto MEB shipping.

Blue Pre-Game Actions

Early July 2010. As a result of Red's declaration to close the Strait of Hormuz to US shipping, the 1st MEB is ordered to **embark** aboard amphibious shipping and to depart southern California for the Arabian Sea. Fixed wing assets of the MEB are ordered to prepare to fly to designated airfields in the Persian Gulf. The UAE and Oman have granted landing and operating rights. Loading of the MEB equipment begins in San Diego and Long Beach, California.

Mid July 2010. Amphibious Task Force sails from southern California and begins **movement** to Persian Gulf. **Planning** begins for operations in the Persian Gulf region. Overhead surveillance data is provided to the MEB and ATF to update the threat situation. USAF and SOF planners are embarked for the transit to Hawaii to coordinate the efforts of other forces with the MEB. Initial broad plans are completed and the first set of rehearsals are scheduled as the ATF nears Hawaii.

Third week of July 2010. ATF arrives off the shore of Hawaii. **Rehearsals** are conducted to test off-load and timing of launching assault elements. Upon completion of this rehearsal, adjustments were made to the load plan, and force was re-embarked per the revised load plan.

Force arrives off northern Australia. A second set of rehearsals is conducted to vet the revised plan. Minor adjustments are made to the plan. The ATF sails for Arabian Sea.

Fourth week of July. MEB fixed wing assets arrive at designated airfields in UAE and Oman. Prep for air operations.

Early August. ATF arrives in the Arabian Sea. Carrier Battle Group on station in the Arabian Sea.

Appendix C: Other Issues Identified by Breakout Groups

The opportunity was provided to the game participants to identify shortfalls in conducting STOM and SOA that may not be within the planned scope of this game or may be of interest to other FNCs or have a longer technology horizon than can be managed by the FNCs. This appendix captures those additional issues that were brought forward for consideration.

1. Ability to sustain widely dispersed operational forces. All aspects of logistics must be addressed, but especially the areas of fuel, water, and ammunition. STOM and SOA place tremendous logistics demands on our operational forces, and we are a long way from resolving how logistics is going to keep pace with the enormous distances from the sea-base and the geographic separation of forces ashore. Examples of these logistics challenges include the requirement for:

    - Selective off load of equipment
    - Re-supply of forces beyond the capabilities of surface craft
    - Increase the capability, while reducing the footprint – as we develop requirements for new systems, we must maintain the discipline to keep the footprint of the system and it's supporting system small – our goal should be to make the footprint of new systems smaller than the legacy system they will replace.
    - Alternate fuels/fuel cells to reduce POL requirements
    - Increased lethality of munitions while reducing footprint, i.e. 81mm performance out of a 60 mm mortar
    - Common batteries with improved life
    - Alternative power sources
    - Tool to facilitate the examination of battlespace-wide logistics demand or requirement

2. Shipboard basing of MEB FW Aircraft

    - Added Complexity. With FW basing, amphibious shipping may now be required to operate FW, RW, and landing craft (to include LCAC). These systems have unique requirements in terms of launch and recovery. This will complicate operations and prolong the times required for launch and recovery. Analysis of the complexity of operating this amount of FW from

Amphib decks is necessary before we commit to a complete Seabasing of these assets.

- Operation of LCAC, RW, FW and Transition Times
- Load plan
- Offload

3. MCM – The game investigated and developed issues relating to MCM, primarily the ISR portion. Participants realized that there is much effort required in MCM to develop the desired ship-to-objective capability in STOM and this is a cross-FNC problem that will require coordinated effort. The primary effort, particularly in the sea environment is in locating the mines. The S&T development in this area should be coordinated and leveraged with the Organic MCM FNC.

4. Combat Identification. The ability to accurately differentiate between enemy and friendly forces along with the ability to positively track friendly and enemy targets, will receive increased emphasis in the 2010 timeframe. Efforts to integrate a position location and identification (PLI) device into all platforms and onto all Marines should be aggressively explored. Such an effort would have immediate force protection and quality-of-life implications.

5. Sensors and signatures. In addition to the many issues that were discussed relating to sensors within the scope of the game, additional issues arose that form the basis for further development. These issues are listed along with the desired requirements.

- Battle Damage Assessment.
  - Simultaneous multi-signature capabilities
  - System cross-cueing to provide needed confidence
  - Education and training with higher headquarters to accept non-visual BDA confirmation
- Casualty Identification and Repair (Human and Equipment).
  - Ability to determine type and extent of casualty
  - Automatic generation of repair part or medevac
- Signature Management (Control and Suppression).
  - Better awareness of our own signature vulnerabilities
  - Technologies to reduce signatures of our human ground forces
- Overcoming Denial & Deception/CCD.
  - Ability to exploit all signatures, develop new sensor-capabilities

6. Force Protection in an NBC environment

- Difference between weapons that create mass fatalities versus mass casualties (lethality and destructiveness of weapons) – Important to classify agents to aid in CM preparation.
- Require more portable, handheld detector and systems that allow the MEB to continue to fight ashore
- Ability to detect and defend against weapons employed against forward combat units.
- Ability to decontaminate and protect adjacent and rear areas (to include shipping).
- Dynamic prediction modeling that accounts for terrain, weather, environmental factors, etc.
- The ability to auto-alert through the command systems to avoid contamination
- Requires an end-to-end analysis; it's not just an S&T solution; need to develop DOTMLP solutions concurrent with S&T developments.

Appendix D: C2 Responses to Questions

OTH/BLOS Tactical Communications Relay

What capability do we need to overcome this operational gap?

Radio connection to both ends

Improved SA

OTH communications

Why will this capability solve the problem or provide a "quantum" improvement?

Allows better communications

Allows Commander to C2 his force, make timely decisions

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Over the next hill and up to 400 nm

Relay the JTRS waveforms without additional equipment at user level

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Non terrestrially based infrastructure

Non satellite based

Operate from ships

All weather

24/7 capability

manned or unmanned

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Applicable to a wide range of operations

Use across the spectrum of military operations

Use at sea and ashore

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Information Management/Decision Support Tools

What capability do we need to overcome this operational gap?

Functional C2 system information sharing

Meta data tagging

Automated information management tools to satisfy CCIRs

Semantic web capability (agent based) with level four automated fusion

All data, web based and non-web based

Why will this capability solve the problem or provide a "quantum" improvement?

Dramatic improvement in ability to manage information

Optimize bandwidth utilization

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Manage information from ISR platforms

Varies by echelons of command

Tailored information by the user

Any improvement is good

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Tools cannot slow speed of command

Always available

Software should recognize when path is down - hold and forward when path comes up

Automated re-routing and self-healing

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Full spectrum of conflict

All levels of tactical command

Every clime and place

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Data Flow Optimization

What capability do we need to overcome this operational gap?

Increase bandwidth to and between lower tactical units and increase efficiency of bandwidth utilization

Why will this capability solve the problem or provide a "quantum" improvement?

Reduces amount of data that must be viewed to make a decision

Send what is really needed

Increased speed of decision

Increased speed of command

Optimize capability

Access information

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Optimize data flow to assault platforms and battalion and below

Enable CROP

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

24/7

scalable

every clime and place

speed of command

must not interfere with combat operations

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

24/7

scalable

every clime and place

speed of command

must not interfere with combat operations

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Dynamic Execution from all Assault Platforms

What capability do we need to overcome this operational gap?

Assault forces to exercise full range of C2 during STOM

Connectivity to "-P" versions of AAAV, not just "–C" versions

Why will this capability solve the problem or provide a "quantum" improvement?

Allows the assault force to maximize the maneuver capabilities of the major maneuver systems

The assault force can exploit surfaces and gaps during STOM

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

To all platforms (AAAVs, LCAC, airborne)

Access the data network from the vehicle

Appropriate CROP at all levels of command

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

No significant changes to platform signature

Sea and Land

All weather

24/7

Permissive and non-permissive

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Full spectrum of operations

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Appendix E: ISR Responses to Questions

"Personal ISR package" once the Marine gets ashore

What capability do we need to overcome this operational gap?

Target ID

Target Classification (Multi-spectral) (All signature)

Dissemination (encrypted)

Designation

Precision Location (Target & Friendly, Imbedded Combat ID)

Real Time

Hand Held

Reduced Signature

Attached to UAV—UGV

Linked to unattended sensors

Why will this capability solve the problem or provide a "quantum" improvement?

Currently multiple systems - allows an individual to do what it currently takes a team to do

Allows leveraging other networked systems.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Dissemination Imagery (Still, IR, encrypted, SIPRNET)

Precision location (1M CEP)

Real Time Dissemination (Minutes)

Hand Held (Monocular, HUD, Palm Pilot Size)

Laser Designation (Range to 3000 M)

Attached to UAV UGV

Target ID

Classification

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Controlled Locally

Applicable to MOUT

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Strategic/Operational/Tactical Implications

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Dynamic Navigation

What capability do we need to overcome this operational gap?

Battlespace Visualization

Tailored

Flexible

Integrated Collection

Predictive Modeling

Automated Template Overlays

Track Management

Command & Control

Why will this capability solve the problem or provide a "quantum" improvement?

Provides Integration capabilities

Provides Operators Situational Awareness

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Can be incremental

Surface Craft First

Navigational

Threat I&W

(Return fires)

Same SA picture as at MAGTF

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Communications capability to provide to platforms

Integrate into GCCS I3

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Scalable to other platforms

Adaptable to ground environment

Tailorable to other applications

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Network Architecture

What capability do we need to overcome this operational gap?

Improved network architecture that provides the ability to operate across different security levels and access different levels of data – ability to share data with others including allies and coalition partners – creation of a dynamic "intelligence picture" that integrates different collection sources

The ability to cross queue assets to provide more robust intell picture, determine capabilities, correlate data and dynamically task asset to address targets

Interoperability between sensors

Cross cueing

Fusion & Correlation

Identification

Data Tagging, Sanitization, Filtering, Tailoring

Naval with Joint Implications

Tailored Data Dissemination

Focused on Expeditionary and Combined Arms aspects

Satellite selectable encryption levels

Why will this capability solve the problem or provide a "quantum" improvement?

Need currently exists to integrate all data sources

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Interoperability between sensors

Cross cueing

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Supports bandwidth limited users

Should be HF

Only updates transmitted

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Sea and Land

Ship and shore

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

UAVs (USMC-operated)

What capability do we need to overcome this operational gap?

Organic UAV systems (DE, DW, upgraded Pioneer) & non-organic assets that are operating inland in support of STOM have to be integrated and distributed enroute

Deployable from ships and austere runways (VTOL)

Multiple, Modular Sensor Payloads

Why will this capability solve the problem or provide a "quantum" improvement?

Currently Planned/Programmed Systems provide inadequate sensor and range coverage

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Range (250 NM)

Duration (On station 12 Hours)

Speed

Stealth

Track while hover

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Compatible with sensor packages

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Applicable to broader applications; urban environments

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Appendix F: Maneuver Responses to Questions

Access Assurance

What capability do we need to overcome this operational gap?

Ability to detect and classify/identify mines and obstacles rapidly and covertly.

Ability to conduct in-stride breaching or avoidance of mines and obstacles from LD through the LPP and to the objective.

Ability to mark cleared lanes/mine danger areas and provide information to units transiting the area.

Unmanned and/or standoff systems are preferred.

The ability to create and maneuver through precision breaching.

The ability to create wide-swath breaching that provides maneuver space in the LPZ.

Why will this capability solve the problem or provide a "quantum" improvement?

The capability does not exist today.

Will provide the capability to perform this task rapidly and provide flexibility to the maneuvering force**.**

Develops a less manpower intensive method.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Ability to detect submerged and buried anti-tank/anti assault craft mines and obstacles.

Detect non-metallic mines.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Day/Night, all weather.

Permissive and non-permissive environments.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Sea and Land – LD to objectives.

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

ISR assets that support "precision maneuver" inside the LPZ

What capability do we need to overcome this operational gap?

Timely identification and classification of mines, obstacles, enemy location, other surface craft, other blue forces (all with frequent refresh – frequent enough to reflect changes) and terrain features (less frequent refresh) that will impede progress, or cause the forces to choose a different route to the objective. Indicate areas with unknown contacts or "unswept" area.

Data fusion (compiling all sensor data and eliminating reporting redundancies) with presentation to the decision-maker in a CROP.

Relevant, scalable data (data of interest to appropriate level of command) displayed to the applicable unit commander.

Graphical and audible display of information should be explored with a scaleable window of concern.

Display an aging feature (ability to rapidly indicate change – or lack of change – of items of interest on display) – feature that provides "track quality", i.e., information that reveals the age of the observation.

Greater investment required at battalion level and below rather than higher levels.

Why will this capability solve the problem or provide a "quantum" improvement?

Capability does not currently exist.

Will provide real time "eyes on target".

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Real time.

Near term subset is better than "all or none".

Data fusion in a graphical display.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All Weather

All environments

Day and night

Operable from Ship or Shore

Ability to export to a portable or mobile unit.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Across the entire battlespace

Sea and Shore

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Robust and capable C2 systems at lower tactical levels

What capability do we need to overcome this operational gap?

Timely identification other surface craft, other blue forces (all with frequent refresh – frequent enough to reflect changes) that will impede progress, or cause the forces to choose a different route to the objective.

Data fusion (compiling all sensor data and eliminating reporting redundancies) and presentation to the decision-maker.

Relevant and scalable data (data of interest to appropriate level of command) displayed to the applicable unit commander.

Graphical and audible display of information should be explored with a scaleable window of concern.

Display an aging feature (ability to indicate change – or lack of change – of items of interest on display) – feature that provides "track quality", i.e., information that reveals the age of the observation.

Voice and data communication between craft critical.

Ability to dynamically change the execution plan while underway and transmit that plan to the command ship and other craft in local area.

TTP on execution and maneuvering with large numbers of high speed craft

Ability to change formation of assault wave

Collision avoidance for AAAV

Capability to adjust the supporting fires, aviation C2, breaching operations, and ground C2 to match the plan

Compatible with other similar C2 systems being developed.

Why will this capability solve the problem or provide a "quantum" improvement?

Capability does not currently exist.

Critical to ensure that platforms from multiple sea bases rendezvous at designated locations.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Real time capability

Scaleable depending on the host platform, must be compatible to the individual craft/vehicle level.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Space and power constraints associated with the targeted vehicles should be considered during the development

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Across the battlespace and joint interoperable

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Adaptive Mission Planning

What capability do we need to overcome this operational gap?

Expand upon the existing system prototype for LCAC

Full integration of other systems and relevant databases including ISR, environmental, threat, etc. (MEDAL and EDSS type functionality) to establish a common planning environment and a high level ship to objective maneuver plan, detailed planning down to the craft level.

Ability to simulate plan execution, and rapidly change the plan to accommodate changes. Include variations in load, loading times, craft reliability, SAR plans, etc.

Ability to monitor and dynamically change the plan during execution

Ability to evaluate fuel consumption, offload and transit times, etc

Why will this capability solve the problem or provide a "quantum" improvement?

Provides a rapid means to examine own courses of action and conduct detailed planning to support selected COA

Provides a rapid means to examine enemy courses of action and develop responses to them.

Provides a historical database of previous plans (capability to have off-the-shelf detailed plans) that can rapidly be adjusted for current operation. Eliminates need to "reinvent the wheel" for each exercise or operation.

Encourages collaborative planning across platforms and units

Enables execution of STOM

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Ability to link units BLOS to the objective

Ability to link to LAN and conduct rehearsals and training across platforms over a secure network system

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Ship and shore compatibility

Rugged enough to operate ashore in an austere environment

Secure Communication

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Surface (ashore and afloat) and air platforms

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Land mines and Obstacle Breaching

What capability do we need to overcome this operational gap?

In-stride breaching issues should cover from LD through the beach and throughout the land maneuver space.

Maintain op tempo and momentum of assault

Unimpeded maneuver of forces

Landmine detection and cleared lane and/or mine danger area marking

Ability to rapidly bridge obstacles, ditches, etc.

Sensor to provide rapid, wide area detection of explosives

Identify potential ambush sites, areas where natural features could be exploited to create an obstacle

Why will this capability solve the problem or provide a "quantum" improvement?

Current capabilities are limited or aging, and are manpower intensive.

Current methods are not an integrated capability with the assault echelon combat force, typically a reach-back capability

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Rapid detection of landmines and obstacles to maneuver elements, low observable system preferred.

Unmanned, standoff system needed

Ability to mark cleared lanes and mine danger areas and provide information back to the maneuver units.

Ability to clear the threat once marked and identified.

Proofing with ABV after cleared

Signature management of vehicles is a potential capability

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Should able to keep up with the maneuver force

Assault craft platform/amphibious ship compatible

24/7 all weather

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Sea and land, all terrain and compatible with the sea state limitations of the assault craft

Bridging capability to support maneuver elements up to and including main battle tanks while minimizing impact on lift/logistics support requirements.

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Vertical Assault Force Survivability

Survivability of the vertical assault force outside the range of NSF weapons

What capability do we need to overcome this operational gap?

Affordable, lethal, organic to vertical assault forces

Responsive on-call fires, or family of loitering munitions

Area and point target munitions

A method of targeting the threat and providing the location to the counter-fire asset

Want to extend the counter-battery fires capability to the vertical assault force

Why will this capability solve the problem or provide a "quantum" improvement?

No current capability; provides a fire support umbrella for the vertical assault force out of the NSFS umbrella

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Extend counter-fire and fire support coverage to cover the ground force out to the ranges of enemy indirect fires

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Man-portable goal, ITV threshold, no larger than HMMWV portable
24/7 all weather

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain and altitude compatible with mountain operations

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Decontamination

What capability do we need to overcome this operational gap?

Detection and avoidance at the element/unit level to prevent contamination is preferred

Waterless method needed for forward decontamination during limited logistics support

Neutralization agent that can be provided to forces prior to entering potential threat area.

"Quick" method to cover personnel and equipment to prevent contamination that can be quickly removed and isolated

Rapid restoration of combat power and ability to re-deploy to the AF

Why will this capability solve the problem or provide a "quantum" improvement?

More expeditionary, less resource intensive

Better maintains operational momentum

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

100 percent clean, with means to verify/proofing

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Portable, lightweight, extended duration of neutralization agent

Should be "mainstreamed" into the design/development of equipment

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All climates, elevations, and environments

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Force Protection – Afloat and In-port

What capability do we need to overcome this operational gap?

Sensor package compatible with the speed of advance of the maneuver force that will provide a “look-ahead” capability to identify threat, must be sensitive enough to detect low-observable threats, i.e. rib boats, hang gliders, wooden boats, high speed cigarette boats, ultra light aircraft

Ability to detect explosives with an unmanned system and use directed energy to create a detonation, or disrupt the electronics with the propulsion system on the threat craft.

Responsive on-call fire support and/or armed escort for assault and transit craft

Counter-fire capability from shore based fires, small subs, surface craft, undersea threat

Non-lethal method to disperse large crowds, or an area denial weapon to provide a level of security around the ship or craft

Scaleable solution desired

Timely dissemination of information across platforms and maneuver elements

Why will this capability solve the problem or provide a “quantum” improvement?

Decreases current vulnerability of forces

Provides the Commander greater situational awareness, operational flexibility and protection against the asymmetric approaches of an enemy

What levels of capability are needed (is there some “minimum capability increase” or is any improvement better)?

Detection of threat from man-sized to small boats (air, surface, and sub-surface)

Timely detection, classification, and engage as appropriate, any person or craft (air, surface, or sub) before it gets within its weapons range

Ability to rapidly disseminate threat condition and situational awareness down to the craft and unit level with a link to the CROP

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

24/7 all weather underway in the littoral or in port

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

Underway, at anchor, moored, ashore installations

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

MV-22
Internal transported vehicles

What capability do we need to overcome this operational gap?

Capability to rapidly load, secure, release, and offload internally transported cargo

Provide mobility to the vertical assault forces once on station

Provide a capability for the vertical assault forces to transport “heavy” items once in station

Provide the capability to expand the force protection envelope around the force and transport heavier weapons systems

Act as a tow vehicle for the EFSS and control stations for unmanned vehicles

Fording

Why will this capability solve the problem or provide a “quantum” improvement?

Provides an increased security zone

Increases responsiveness to wide range of threats

What levels of capability are needed (is there some “minimum capability increase” or is any improvement better)?

Employ all the organic weapons of infantry battalion

Common weapons mount

Employ sensor package for recon/scouting mission

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

Transportable by MV22

Multi-fuel/hybrid electric drive/fuel cell/alternate power sources

Rough terrain capability

Speed compatibility with HMMWV or Special Forces vehicles

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Appendix G: Fires Responses to Questions

Target Location

What capability do we need to overcome this operational gap?

The Marine of 2010 must have the ability to provide targeting confidence.

The ability to generate mensurated target location, designate, transmit call for fire, and engage within USMC standards.

Balance size versus range, power supply, initialization,

The system should be capable of providing targeting, transmission, and engagement in real time, and be hands-free to allow for calling and controlling fires while retaining situational awareness.

It provides accurate target location and designation out to the maximum extent possible.

It must provide the ability to reduce initialization time.

Why will this capability solve the problem or provide a "quantum" improvement?

This capability reduces or eliminates the requirement for sensor confirmation on precision targets and volume fires.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

It must be reliable with long duration power supply.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All-weather and all-visibility capability.

Hands-free to allow for calling and controlling fires while retaining situational awareness

Day or night, with minimum weight and the ability to set-up on the move

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes and missions

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Netted Fires

What capability do we need to overcome this operational gap?

A system is required that possesses the ability to tie in sensor, C2, and engagement platforms and systems across the battlespace.

It must provide the capability for weapon/target matching and target deconfliction with the ability to create an automated sensor-to-shooter engagement architecture.

The network must be supported by over-the-horizon comms.

The system must provide increased responsiveness of fires during the operation, especially during STOM.

It must enable more efficient weapon-target pairings and increased ability to manage resources.

Why will this capability solve the problem or provide a "quantum" improvement?

Speeds up the targeting cycle

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

It must be interoperable and mutually supporting of other systems and integrate all C2 and fire support systems (GCCS, AFATADS, TBMCS, etc).

It must comply with Joint Tactical Architecture DII COE.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All-weather, 24/7.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes and missions

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Ashore Counterbattery

What capability do we need to overcome this operational gap?

The ability to detect, acquire and fix threat indirect-fire systems' locations (360 degrees) at the range of threat weapons, employing a light, portable system capable of operating on the move and transitioning ship-to-shore and transmitting target locations to the counterfire network.

Light, portable counterbattery system capable of operating on the move.

The system must support transition from ship-to-shore while transmitting target locations to a dedicated counterfire network.

Why will this capability solve the problem or provide a "quantum" improvement?

Provides greater force protection and responsiveness to enemy fires.

This system provides protection and counterbattery capability while on the move. It supports transition through the LPZ.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Small power supply and efficient computing power to target in less than 3-D, and man-safe operations.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All-weather, 24/7.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes and missions

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

The "Cost" of Fires

What capability do we need to overcome this operational gap?

The requirement exists for an extended range munition (beyond the range of ERGM) that can be fired in volume, with a size and weight less than current ballistic rounds, and with adjustable "yield/effect" capabilities that can be fired from sea-based platforms.

This system must fire ammunition sub-components (explosive filler, guidance systems, and fusing) that possess commonality and a reduced cost guidance system must be developed to support volume fires.

Future systems and munitions must address the following problem areas. Precision systems are expensive and cannot produce volume fires at an acceptable cost (ERGM Guidance = approximately 80% of the cost). "Dumb" systems do not have range to support STOM doctrine, especially in urban areas where collateral damage is a consideration. Magazines "cube out" when precision munitions are employed.

Why will this capability solve the problem or provide a "quantum" improvement?

Corrects the deficiency of the lack of responsive fire support coverage throughout the battlespace.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Compatibility of Naval fire and MEB systems, reducing the burden on magazines, logistic systems, etc.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All-weather, 24/7.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes and missions

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Responsive Targeting and Taskable Firing System

What capability do we need to overcome this operational gap?

A system that reduces the time from acquisition and targeting to arrival of ordnance.

The system must be a reduced Time-of-Flight (TOF) weapon that still achieves the effects required by the MEB commander to address both precision and volume fires.

It must possess station time to ensure duration coverage, dwell, and ability to assess and reattack as required. Munitions should provide the ability to "dial up" the effects required.

Commanders need systems that support constant stare and dwell. Loitering munitions and long-range, sea-based munitions with reduced TOF provide the ability to attack time-sensitive and other high pay-off targets in the most efficient manner.

Why will this capability solve the problem or provide a "quantum" improvement?

Reduces time-of-flight and increase responsiveness

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

Lower cost, responsive systems that more effectively support the tactical call for fire.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All-weather, Day and night, 24/7.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes and missions

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Modular, Lightweight, Mobile Weapon Systems

What capability do we need to overcome this operational gap?

A lightweight system is required for organic employment with MEB elements. The system must be internally transportable by MV-22, capable of achieving the effects of all indirect fire systems currently organic to the MEB with mobility comparable to maneuver units once deployed.

This capability must reduce the footprint ashore and must address logistics, interoperability and compatibility issues. Current fire support systems must be employed in "layers" where gaps may affect maneuver. Multiple systems complicate the targeting process and increase interconnectivity issues and Fire Direction Center coordination/target deconfliction.

Why will this capability solve the problem or provide a "quantum" improvement?

Reduces gaps with multiple systems.

Reduces complication of firing process.

What levels of capability are needed (is there some "minimum capability increase" or is any improvement better)?

The near term solution for this capability may be enhancements to the EFSS program. Desirable changes would be transportable with ITV as prime mover for vertical assaults, internally transportable with an ITV in the same MV22, transportable with a LAV, AAAV, or HMMWV as prime mover for surface forces, an increase in the range of the system, and small but common munitions.

What circumstances/constraints need to be included in developing this capability (e.g., size/portability, day/night, weather, emissions)?

All-weather, Day and night, 24/7, all terrain.

How broad is the applicability of this capability (utility limited to specific cases, or applicable to a wide range of operations)?

All terrain, environment, altitudes and missions

Can we achieve this capability with modifications to Doctrine, Organization, Training or Education?

No

Appendix H: Mapping and Frequency of Breakout Group Issues into Common Descriptions

Table H-1 portrays the mapping of the 23 issues derived by the game participants into 18 system specific issues as presented in Section 8 of the report. The number in parenthesis by the group name represents the priority of the capability within the group. Maneuver issues are from vignette one unless indicated as vignette two.

Table H-2 provides the frequency with which the consolidated issues were developed independent of the other groups within each Breakout Group.

Table H-1. Mapping of Issues

STOM C2	Robust and Capable C2 System (Maneuver 3) Dynamic Execution from all Assault Platforms (C2 4) Dynamic Navigation (ISR 3)
OTH/BLOS Tac Comm Relay	OTH/BLOS Tactical Communications Relay (C2 1) OTH/BLOS Tactical Communications Relay (Red 7) Netted Fires (Fires 2) Assured Access (Maneuver 1)
IM/Decision Support Tools	IM/Decision Support Tools (C2 2)
Data Flow Optimization	Data Flow Optimization (C2 3)
Remote Unmanned Sensor	Assured Access (Maneuver 1), ISR supporting Precision Maneuver (Maneuver 2) Landmines and Obstacle breaching (Maneuver 1, vignette 2) Decontamination (Maneuver 3, vignette 2) Force Protection (Maneuver 4, vignette 2) Responsive Targeting (Fires 5) Locally controlled UAVs (ISR 2) Responsive Targeting (Red 2) Assured Access (Red 3) ISR supporting Precision Maneuver (Red 4) Identify, Classify and Shoot Multiple Small Targets (Red 4)
Personal ISR Package/Target Locating Device	Personal ISR Package (ISR 1) Target Locating Device (Fires 1)

Organic UAV	Locally Controlled UAVs (ISR 2) Assured Access (Maneuver 1) Landmines and Obstacle breaching (Maneuver 1, vignette 2) ISR supporting Precision Maneuver (Maneuver 2) ISR supporting Precision Maneuver (Red 4) Identify, Classify and Shoot Multiple Small Targets (Red 4)
Network Architecture/ Netted Fires	Network Architecture (ISR 4) Netted Fires (Fires 2) Improved Network Architecture (Red 1) Identify, Classify and Shoot Multiple Small Targets (Red 4)
Mine Breaching/Clearing	Assured Access (Maneuver 1), Landmines and obstacle breaching (Maneuver 1, vignette 2)
Force Protection Non-Lethals	Force Protection (Maneuver 4, vignette 2) Non-Lethal Weapons (Red 5)
Decontaminant	Decontamination (Maneuver 3, vignette 2)
Adaptive Mission Planning System	Adaptive Mission Planning (Maneuver 4)
ITV	ITV (Maneuver 5, vignette 2)
Ashore Counter-battery	Ashore Counter-battery (Fires 3)
Reduce “cost” Of Fires	Reduce “cost” of Fires (Fires 4)
Loitering Munitions	Responsive Targeting (Fires 5) Responsive Targeting (Red 2)
New Modular, Lightweight Mobile	Modular, Lightweight Mobile Weapons Systems (Fires 6) Vertical Assault Force Survivability (Maneuver 2, vignette 2)
EFSS Enhancements	Vertical Assault Force Survivability (Maneuver 2, vignette 2) Modular, Lightweight Mobile Weapons Systems (Fires 6)

Table H-2. Frequency of Issues

	Red	ISR	C2	Maneuver	Fires
STOM C2		I	C	M	
OTH/BLOS Tac Comm Relay	R		C	M	F
IM/Decision Support Tools			C		
Data Flow Optimization			C		
Remote Unmanned Sensor	R	I		M	F
Personal ISR Package/Target Locating Device		I			F
Organic UAVs	R	I		M	
Network Architecture/ Netted Fires	R	I			F
Mine Breaching/Clearing				M	
Force Protection Non-Lethals	R			M	
Decontaminant				M	
Adaptive Mission Planning System				M	
ITV				M	
Ashore Counter-battery					F
Reduce “cost” Of Fires					F
Loitering Munitions					F
New Modular, Lightweight Mobile Weapons System				M	F
EFSS Enhancements				M	F